The FOUNDRY

Volume 54
Number 6

Published
Semimonthly

CLEVELAND, OHIO, MARCH 15, 1926

Castings Help as Compressed Air Finds Use in Industry

WHEN Ctesibius of Alexandria, about 250 B.C., invented a tube from which an arrow was shot by compressed air, he applied a principle which is being used in modern times to ease the labors of mankind. Compressed air first was used for industrial purposes about the middle of the 17th century, when Otto von Gue-

Portable Tools Are Made in a Variety of Sizes and Styles

ricke invented an air pump, and Denis Papin developed the first pneumatic tube for the despatch of letters and messages. Of the many ramifications of compressed air machines, portable pneumatic tools probably are the best known, since they have been applied to many processes in industry. Included in the list of portable tools driven by air are scaling hammers, calking hammers, rivet busters, riveting hammers, chipping hammers, drills of various kinds, reamers, hoists, grinders, buffers, sand rammers, die sinkers and pattern carvers, stone carving tools, sand sifters, and rock drills. Castings are used in the construction of practically all portable pneumatic tools, as well as in the machines used to compress the air. While the value of pneumatic tools manufactured in this country is not reported by the department of commerce, the value of all types of portable tools produced in 1923, the last year for which figures are available, was $35,981,514.

Find Where Castings Can Be Sold

CONTENTS

Page

Embrittlement in Malleable Is Avoided—By Edwin Bremer. 212

Can Used Sand Be Reclaimed—II—By Pat Dwyer 216

Ancient Methods Prevail in Central China—By Frank A. Foster 220

Describes Loam Molding Methods—By Ben Shaw and James Edgar 225

Melt High Chromium Alloys in Acid Furnace—By R. S. Kerns 229

Bill Describes a Hydraulic Ram Pattern—By Pat Dwyer 232

Plan Pipe Standardization 237

Pattern Design Influences Production—By Rupert Hall 238

Consider Weights on Blueprints—By Fred Pletcher 239

Oven Design Shows Advance—By C. A. Barnett 240

Gives Pattern Detail and Method of Molding Axle Box—By Joseph Horner 242

Measuring Was Ancient Art—By Walter C. Ewalt 244

Engineering Training Is Applied to Foundry Problems 245

How and Why in Brass Founding — By Charles Vickers 235

The Shakeout 246

Trade Trends in Tabloid ... 247

Comings and Goings of Foundrymen 248

Equipment Market Report. 252

What the Foundries Are Doing 253

New Trade Publications ... 254

—⊡—

PUBLISHED BY THE PENTON PUBLISHING CO., CLEVELAND, O.

BRANCH OFFICES

BOSTON ..... 1037 Old South Bldg.
CHICAGO ..... 1147 People's Gas Bldg.
CINCINNATI ..... 408 Edwards Bldg.
NEW YORK ..... 2203-2206 No. 220 Broadway
PITTSBURGH ..... 2148-49 Oliver Bldg.
SAN FRANCISCO ..... 24 California Street
WASHINGTON, D. C. ..... 401 Westory Bldg.

FOREIGN OFFICES

BIRMINGHAM, ENGLAND ..... Prince's Chambers
LONDON, ENGLAND ..... 2-3 Caxton House Westminster, S.W.I.
PARIS, FRANCE ..... 23 Rue de la Bienfaisance VIIIe

Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico ..... $3.00 a year
Canada ..... $4.00 a year
Great Britain and other Foreign Countries ..... £1:0:0 a year
Single Copies ..... 25 cents

Copies published three months or more previous to date of current issue, 50 cents each

Member, Audit Bureau of Circulations, Associated Business Papers, Inc., National Publishers Association
Entered at the Post Office at Cleveland as Second Class Matter
Copyright 1926 by The Penton Publishing Co.

Embrittlement in Malleable

New Process Removes Galvanizing Difficulties and Aids Machining

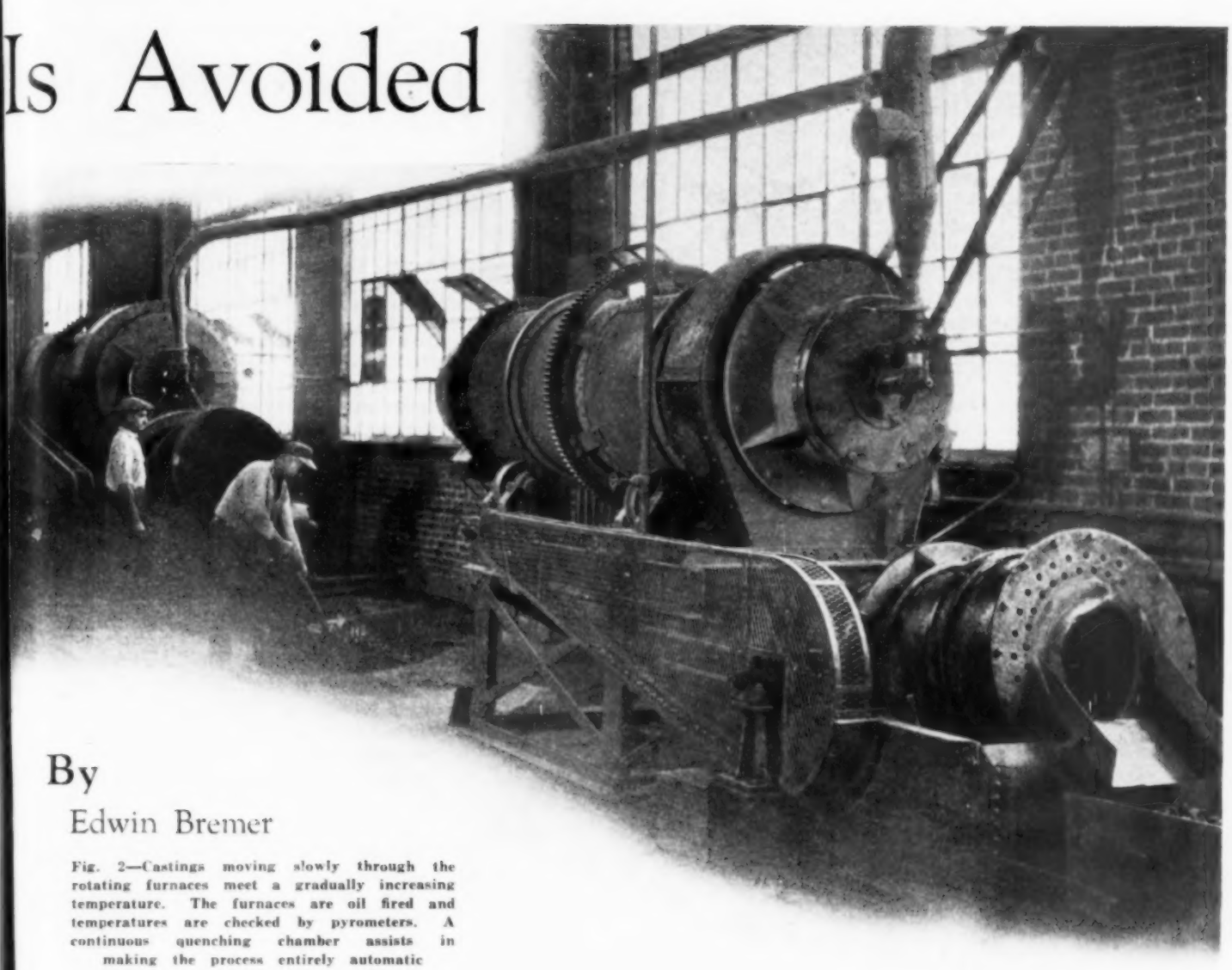
EMBRITTLEMENT of malleable cast iron subjected to the hot-dip galvanizing process, has been the shrouded specter that at times has confronted the galvanizer and the manufacturer ever since the demand for rust and corrosion proof malleable iron has been known. Moldenke in his book, *Production of Malleable Castings*, published in 1911, suggested the use of sherardizing instead of galvanizing to prevent the castings from becoming too hard to be threaded.

Sherardizing consists of applying a zinc coat to iron by the dry process. The annealed malleable castings are cleaned by sand blasting to remove any scale or burned-on sand, placed in a lye bath to remove any grease and then washed thoroughly with hot water. The castings next are pickled in hydrofluoric acid to remove all foreign matter, washed in hot water and then placed in a boiling solution of cyanide to counteract any remaining acid. The castings are dried and packed in the sherardizing drums between layers of zinc dust. These drums are set in a furnace and brought to a temperature between 823 and 843 degrees Fahr. and held at this temperature for 5½ hours. The drums are rotated slowly to coat the material thoroughly with zinc. Although the temperature at which sherardizing is carried on is lower than that of galvanizing, embrittlement occurs. The process also is more expensive than that of galvanizing, and the finish obtained is not as bright. Embrittlement in zinc coated castings, regardless of the process used, continued to occur without any satisfactory explanation and gradually grew worse when the higher tensile strength specifications for mallable were developed and standardized by the American Society for Testing Materials. The physical properties of malleable iron depend greatly on the carbon content and in order to increase the tensile strength, the carbon is maintained between 2.40 and 2.50 per cent. This lower carbon is necessary, because every additional carbon granule decreases the tensile strength.

Since the carbon is lowered, an increase of silicon follows. Silicon is used to control the graphitization of the carbon and if none is present, the graphitization is retarded to a commercially prohibitive degree. These two factors, lower carbon and higher silicon, seemed to increase the tendency toward brittleness in hot-dip galvanizing, so much so, that the maker of malleable castings would only guarantee a delivery of good castings to the galvanizer. Any defect after galvanizing was borne by the galvanizer. Since many manufacturers desired galvanized malleable iron castings, the situation was rather strained. The Ohio Brass Co., Mansfield, O., one of the largest manufacturers of high tension electrical insulators and railway

FIG. 1—CASTINGS ARE HAND DIPPED IN GALVANIZING. BATH TEMPERATURES ARE REGULATED CAREFULLY AND HOODS CARRY OFF FUMES THAT MIGHT ENDANGER THE WORKMEN'S HEALTH

ls Avoided



By

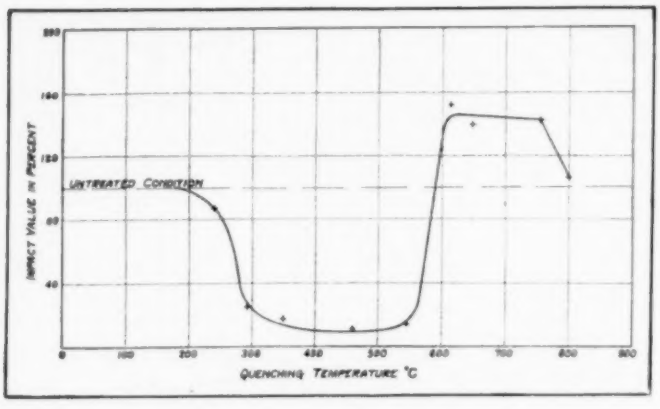
Edwin Bremer

Fig. 2—Castings moving slowly through the rotating furnaces meet a gradually increasing temperature. The furnaces are oil fired and temperatures are checked by pyrometers. A continuous quenching chamber assists in making the process entirely automatic

equipment, had its attention forcibly drawn to the problem of brittleness by high losses of a casting used on insulators, that was given an individual physical test. This loss ran from 20 to 40 per cent and caused much apprehension as to whether this casting ever could be made satisfactory when given a hot-dip treatment. After some consultation it was decided to institute a research investigation and determine the root of the trouble. L. H. Marshall, metallurgist, was assigned this difficult task under the supervision of Fred L. Wolf, technical director.

The investigation was started in 1921 and entailed considerable search through all available literature. The latter gave but little definite information on the subject. Authorities in the metallurgical field and various other sources of information including government bureaus were consulted without avail. In some quarters it was believed that pickling was responsible for the deterioration, but through a series of impact tests it was shown that pickling the castings did not give divergent results and accordingly was not held responsible for the condition. The etching effect of molten zinc was considered, as it was thought there was a possibility of the zinc causing small scratches that would be starting points of larger fractures. Tests disproved the danger from this source. Observations of conditions led the investigators to believe that embrittlement was a function of heat treatment rather than chemical composition and the problem was attacked from this angle.

After carrying out numerous other tests, Mr. Marshall decided to run a series of heat treating and quenching tests. Taking the regularly annealed material as 100 per cent under the impact test, the specimens were subjected to various temperatures and quenched. Impact tests were performed and it was found that the value dropped gradually as the temperature increased and reached the lowest point between 750 and 930 degrees Fahr., or near the temperatures at which hot-dip galvanizing and sherardizing are carried on. However, it was noticed that the resistance to impact increased sharply after this point and gave values of 50 per cent more than the original untreated specimens around 1200 de-



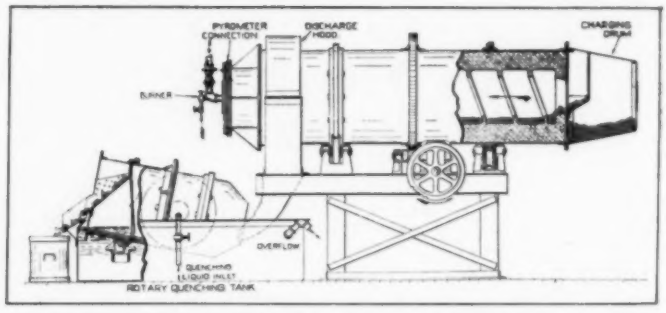


FIG. 3, LEFT—RESISTANCE TO IMPACT DECREASES AS TEMPERATURE INCREASE. FIG. 4, ABOVE—SECTIONAL VIEW OF FURNACE SHOWS SPIRAL LININGS IN FURNACE AND QUENCHING TANK

grees Fahr. The results obtained from these tests were plotted and a curve drawn which is shown in Fig. 3. Specimens heated to 1200 degrees Fahr., and quenched were galvanized by the hot-dip process and found to suffer no embrittling effect.

Since the experimental tests showed a good uniform product, the heat treatment after the regular anneal was patented and put on a production basis.

The average analysis of the malleable iron produced by the Ohio Brass Co., is: Silicon, 0.80; manganese, 0.35; sulphur, 0.05; phosphorus, 0.15; and carbon, 2.75 per cent. This analysis has been found to work well in the type of castings turned out at this plant. By increasing the silicon, the tensile strength could be advanced, but that would make it harder to secure sound castings. To care for any lowering of tensile strength, the sections are made thick enough to have a large factor of safety. The castings are given the regular anneal and then heat treated. The method as practiced at this plant is as follows:

The white iron castings are annealed in furnaces designed by the Holcroft Co., Detroit, and described in the July 1, 1922 issue of THE FOUNDRY. These furnaces shown in Fig. 5, are fired by powdered coal and pyrometers are used to check the temperatures. The temperature is brought up to 1650 degrees Fahr., as quickly as possible and held at this temperature for 60 hours, after which the castings are allowed to cool at the rate of 5 to 10 degrees per hour until the critical range is passed. Then the doors are opened and after cooling to a handling temperature, the boxes are removed from the furnace and the castings dumped on the floor. Ordinary gravel, fairly high in silica, is used as a packing to prevent warping or sagging of the castings during the annealing period.

The castings then are shoveled into steel tote boxes and conveyed to the furnaces for secondary treatment. Two rotating furnaces which will be described later, and one semimuffle furnace comprise the units used in this secondary treatment. In case of the rotating furnace, the castings are shoveled in one end and the slow rotation of the furnace carries them through the heating chamber slowly enough so that all parts of the castings assume the furnace temperature of approximately 1200 degrees Fahr. On reaching the opposite end of the furnace, the castings are quenched suddenly in hot water at the temperature of about 175 degrees.

The furnaces used in the heat treating process are of two types, as was stated, the rotating and semimuffle type furnaces. Both types are oil fired. The rotating furnaces of which there are two, were built by

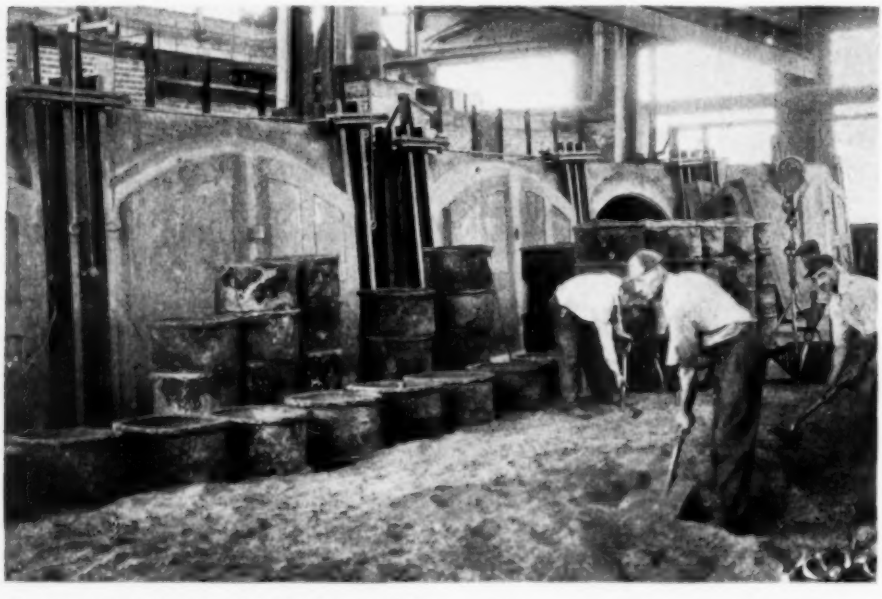


FIG. 5—ANNEALING FURNACES, PYROMETRICALLY CONTROLLED, GIVE UNIFORM PRODUCT. ORDINARY GRAVEL IS USED FOR PACKING MATERIAL

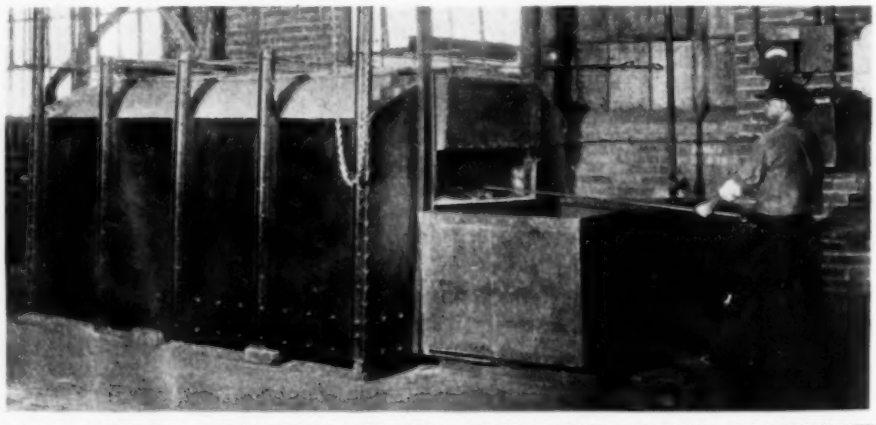


FIG. 6—OIL-FIRED SEMIMUFFLE FURNACES HEAT TREAT CASTINGS OF INTRICATE FORM THAT MIGHT BE DAMAGED IN THE ROTATING FURNACES

the W. S. Rockwell Co., New York. One of the furnaces is 15 feet long and the other is 20 feet long. The 20-foot furnace shown diagrammatically in Fig. 4, has a revolving horizontal cylinder with a metallic spiral lining which is backed up with refractory material between the lining and the outside shell. The cylinder is mounted in two steel rings which rest on steel rollers that allow it to rotate. The cylinder is motor driven, the motion being transmitted by a chain and suitable gears to the large gear mounted on the center of the cylinder.

The material placed in the charging drum is automatically conveyed through the numerous convolutions in the lining to the discharge end. The oil burner is placed at the discharge end, and as the castings move along they meet with a gradually increasing temperature. A heavy casting through which the burner is inserted is mounted on the discharge end of the cylinder. Fuel oil is used for fuel with soft blast air supplied through a 5-inch pipe, for combustion purposes. A concentric hood made of heavy steel serves to cover the discharge opening and guide the discharged material to a continuous quenching tank. This tank which is driven by the motor, has a spiral lining that carries the castings from the quenching bath to the opening where they are discharged into suitable receptacles.

Correct heat treating temperatures are maintained uniformly by pyrometric control and manipulation of oil and air at the burners. This furnace burns about 8 gallons of oil per hour and has a capacity of 2400 pounds of castings during this time. A view of the rotating furnaces is shown in Fig. 2, and that of the muffle furnace in Fig. 6.

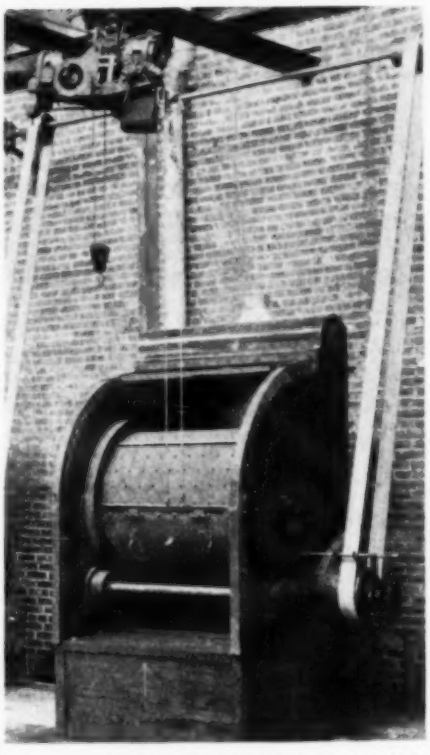


FIG. 8—SANDBLAST CABINET HAS ROLLER-CURTAIN WHICH SLIDES BACK AND ALLOWS THE BARREL TO BE FILLED DIRECTLY FROM A BOX

The operation in the muffle furnace is the same except that the castings are pushed through the furnace by hand. Although the temperature at which the heat treating is done, is under pyrometric control, a further check is maintained to assure that this treatment has been uniform.

This check consists of heat treating the castings, some of which are shown in Fig. 9, in 300 pound lots and taking a casting from each lot. The casting is put in a vise and hammered to determine its malleability. Since too high a temperature causes dissolving of the graphitic carbon along the grain boundaries, and too low a temperature results in brittleness, the hammer tests immediately show any variation from good practice.

After the heat treatment and quenching, the castings are taken to the sandblast room and cleaned, preparatory to the galvanizing operation. The sandblast machines of the suction type which were designed by F. R. Dippman, technical engineer, were installed three years ago and at that time were a radical innovation. The features incorporated are, totally enclosed bearings and gears, the use of roller bearings for moving parts, and the use of a single shaft drive. One of these machines is shown in Fig. 8. Each barrel has a capacity of 600 pounds. Another feature is the use of the cut-off, steel, roller-curtain door. Previous to this innovation, the sandblast barrels were in cabinets or arranged so that the curtain moved vertically upward. Consequently when the opening in the barrel was on top or the position for charging, the curtain interfered

(*Concluded on Page* 231)

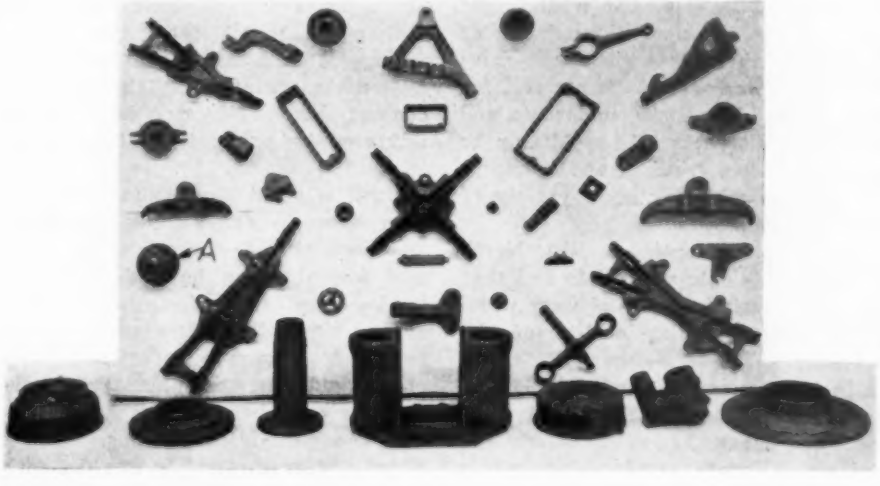


Fig. 7—Below—Careful inspection culls the defectives. Plenty of light aids the inspector in scrutinizing the castings closely Fig. 9—Right—Castings of various shapes undergo the heat treatment. The smaller ones are treated in the rotating furnaces, and the others in the semimuffle furnace. Casting marked A is the insulator fitting mentioned

Can Used Sand Be Reclaimed-II

Infinite Variety of Natural Deposits Demands Widely Different Treatments—Economy Is Determining Factor in Methods Adopted as Shown by Replies to a General Questionnaire

By Pat Dwyer

PRACTICAL difficulties that lie in the way of establishing set rules to govern the mixing and using of sand are illustrated in the almost countless variety of facing sand mixtures in use. This is due to some extent to the slavish persistency with which the majority of men follow custom and tradition, but it is due to an even greater extent to the difference in physical characteristics and chemical composition between grades of sand from various deposits.

Molding sand in Great Britain varies considerably from that found in Belgium, and the Belgian sand differs from that found in France or Germany. One deposit of sand near Paris is not duplicated elsewhere on earth. If there is a sand anywhere like it, that sand has not yet been brought to the attention of foundrymen. It is used exclusively for making statuary and other art castings and is exported to every foreign country where castings of that description are made.

This sand possesses the apparently contradictory characteristics of fine and coarse sand. It will take and retain the finest impressions and at the same time it is so porous that gas and steam flow through it as readily as through a sieve. It dries hard when exposed to the air and for that reason drawbacks, undercuts and other difficult parts of a mold may be handled with a freedom and impunity not possible with any other variety of molding sand.

In a large continent like North America it is only natural to find that the characteristics of sand vary widely according to the locality of the deposits. This is shown quite clearly in the accompanying Table I, prepared by Eugene W. Smith to illustrate a paper he read before the Chicago Foundrymen's club. This table only includes a few of the 1000 samples of sand examined by Mr. Smith, but it is sufficient to show the exceedingly difficult task confronting the American Foundrymen's association committee in its endeavor to formulate a set of standard tests applicable to the selection of molding sand.

Facing Sand Formulas

After a suitable sand has been selected the problem of preparing a facing that will give maximum results in the shape of a clean, smooth and unblemished surface on the castings still remains. Many foundrymen, particularly those lacking in practical experience and therefore ardent believers in *The One Best Way To Do Work* theory, cannot understand why the sand sharps cannot lay down definite rules for their guidance.

When they buy cement they know that a certain definite proportion mixed with sand or aggregate will result in a product that has certain characteristics that conform to anticipated specifications. The same mixture will meet the same set of specifications in any part of the country. If this is true with cement, why cannot definite rules for the mixture of sand be laid down in the same manner? In some instances, they are willing to admit that green sand facings present some hazard owing to a possible variation in the moisture content, but surely dry sand facing mixtures should be standardized easily.

Until a great deal more work has been done in establishing standards and methods of comparison no definite formulas can be laid down for mixing dry sand facing that will apply universally. This readily is apparent from even a superficial study of the difference in physical characteristics and chemical composition between sands from various sources. Thus a formula which specified one part binder to 10 parts sand might work satisfactorily with a fairly open grain sand. The same amount of binder with a fine sand would cause buckles and scabs on the face of the mold. With a coarse open sand containing a minimum of natural binder, 10 per cent artificial binder would not be sufficient. The face of the mold would crumble at the slightest touch and the sand in front of the gates would *wash* before the erosive action of the stream of molten metal.

Any sand that will make satisfactory green-sand molds will make equally satisfactory dry-sand molds, if due allowance is made for the fact that the addition of a certain amount of binder decreases the porosity. For example if the green sand must be vented extensively, then it will be necessary to add sharp sand to the dry sand mixture to offset the closing effect of the artificial binder. With a knowledge of this fundamental fact it is possible to *doctor* any grade of sand. However, suitable grades of natural sand are available in nearly all parts of the country and a foundry man only has to use common sense instead of blindly compounding mysterious mixtures, simply because the oldest inhabitant says they always did it that way.

Where the sand is prepared mechanically, any good grade of open sand may be mixed in varying proportions of new and old sand. The amount of new sand will range from 10 to 50 per cent, depending on the size and shape of the proposed casting. Any kind of binder may be used, but it must be added with due regard to its binding power and the extent to which it supplements the natural binder in the sand. The ideal dry-sand facing is one that will bake hard and firm and at the same time retain a maximum of permeability for the escape of gas generated when the mold is filled with metal. It is scarcely necessary to add that the sand should be highly refractory, or in other words that the silica content should be above 80 per cent.

Every now and again an impatient foundryman rises to ask why some clever and competent person does not establish a set of sand analyses that could be applied in relation to the weight of a casting.

No Standard Established

If any person could establish a method, a system or a set of tests of that kind he would merit the gratitude of nearly every foundryman and sand producer in the country. If it were possible to judge sand solely by analysis, the troubles of the foundryman would be reduced by at least 50 per cent. If the weight of the castings furnished a criterion by which to select the sand, the problem no longer would be a problem. Any experienced foundryman knows that a much more refractory and open sand is required for a chunky 200-pound casting than for a 1500-pound casting in which the section is thin and where the cast-

ing is spread over a large area.

Analysis is only one of the features to be considered when ordering sand. Refractoriness, permeability, strength, amount, quality and distribution of bonding material all are important features. From an endurance viewpoint a relatively high first cost sand may prove more economical over a period of time than another sand satisfactory in every respect with the single exception that it has a short life and must be renewed frequently.

A prominent feature of nearly all eastern sands is that they are high in silica, open in grain and, therefore, may be rammed quite hard. Western sand under like conditions would produce nothing but scrap. As a compensating measure western sands usually hold their bond longer than sand from eastern deposits.

A great deal of research work has been done in an attempt to standardize tests by which sand may be graded in relation to the particular use to which it is to be applied, but up to the present no practically definite standards have been established along this particular line. Many individual plants have worked out standards for their own requirements and select their sand according to empirical formulas. These standards only are capable of application in other plants where perfectly identical conditions prevail.

Foundrymen who are fortunate enough to have a reliable source of supply, continue to place their orders with sand supply houses in which they have confidence as a result of doing satisfactory business over a short or long period. Laboratory tests have been developed for judging the qualifications of molding sand, but up to the present the necessary equipment only has been installed in a small number of foundries.

The Shop Test

Experienced foundrymen trying out a new sand base their conclusions on a practical shop test after the preliminary *feeling* test has indicated that the sand is worth a trial. They bring the new sand into actual contact with the molten metal under operating conditions and note its behavior. What a man hears may leave little impression on his mind but what he sees with his own eyes is the most convincing kind of evidence.

Since this series of articles is based on actual operating conditions rather than on a discussion of laboratory tests and since later in the series an account will be presented of the practice pursued in several prominent foundries where clay has been substituted for new sand as a rejuvenating medium, it seems pertinent at this point to quote from a letter written by T. C. Flinn, foundry engineer, Worthington Pump & Machinery Corp., Cambridge, Mass.

Replying to an inquiry from one of its readers THE FOUNDRY had stated that the regular method of renewing the bond in used foundry sand was by the addition of new sand. Taking exception to this statement Mr. Flinn wrote in part as follows:

In the answer to an inquiry which appeared in a recent issue of THE FOUNDRY the concluding lines seem to indicate that the only commercial method for renewing old sand is to add new sand. Evidently you are not aware that a better and a cheaper sand may be prepared by the addition of a clay binder. It is true that attempts to rejuvenate sand in this manner failed in the past, but that was due to the poor quality of the clay and the lack of intelligent application and perhaps supervision.

Guided in their work by the sand testing methods developed by the American Foundrymen's association, many foundries continuously and successfully are rejuvenating old sand by the direct and simple application of a clay bond. If necessary I can furnish the names of a number of foundries where no new sand has been used for this purpose for periods ranging from 6 months to 2 years.

With a view of securing a fairly accurate cross section of the opinion of American foundrymen, a questionnaire was sent to a large number of representative foundries in every state in the union and to the Canadian provinces adjoining. In this way it was felt that a fuller and freer expression of opinion could be secured than at a formal convention. Geographical location, business affairs and personal reasons automatically limit the number of men who can attend a convention. The time factor automatically limits the number of papers that may be presented and still further limits the discussion that properly should follow the presentation of these papers.

The unusually large number of replies received to this questionnaire indicates, among other things, that the foundrymen almost without exception are deeply interested in the subject and will welcome any light that may be thrown upon it either from the inside or the outside.

Table I

Samples of American Molding Sands

	Opener	Binders		Of no particular molding value					
	SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO	Alkalies	SO_3	Fineness	Texture and finish
Tennesse	92.96	3.10	4.92	.....	.....	0.26	.....	98.58	Fine Weak Open
Long Island, N. Y.	89.16	2.92	4.66	.....	0.33	0.33	.....	0.53	Coarse Weak Open
New York	82.34	4.24	8.50	0.96	0.40	1.79	0.54	1.70	Coarse Strong Open
Indiana	82.50	2.70	8.90	0.16	0.61	1.47	.....	0.50	Coarse Strong Open
Wisconsin	82.87	2.67	8.45	0.80	0.89	1.60	trace	57.3	Medium Strong Open
Indiana	79.66	9.74	3.36	1.34	0.68	2.50	.....	78.34	Medium Strong Open
South Carolina	79.30	4.10	10.70	1.19	1.29	.....	.....	.....	Strong Open
Kentucky	76.16	4.24	12.02	.....	0.72	1.21	.....	.....	Open Fine Strong
Ohio	77.14	6.44	9.20	trace	0.91	1.10	.....	.....	Strong Open
Illinois	75.70	13.46	3.00	0.60	1.08	2.15	0.19	0.60	Coarse Strong Close
Illinois	56.80	5.09	14.43	6.40	5.60	3.15	0.14	70.24	Fine Strong Very close

For the benefit of those who did not receive a questionnaire a facsimile is shown in Table II, accompanying. Readers who are interested may fill it in according to conditions prevailing in the particular plant with which they are connected and then may draw their own conclusions on how their practice compares with that prevailing elsewhere. From the list submitted about 30 were selected at random and representing the wide diversity in practice almost as fully as if the entire list were presented. These are shown in Fig. III.

In addition to filling in the questionnaire formally as requested several foundrymen commented on the subject more or less informally in the space set apart for remarks at the bottom of the sheet. Some of these comments were presented as applying to the foundry industry in general.

TABLE II

Specimen of Questionnaire Sent to Foundries

Tons of new molding sand used per year { coarse ..... / fine .....
Average amount of metal melted daily .....
Class of castings. Iron ..... Steel ..... Malleable ..... Nonferrous .....
Agricultural
Automobile
Light jobbing
Heavy jobbing
Railroad
Stoves and heaters
Is the sand cut by machine? ..... By hand? .....
Is the facing prepared by machine? ..... By hand? .....
Is the sand handled on a conveyor? .....
Name of Mixers: Blystone ..... Standard ..... Link-Belt ..... Sellers .....
Simpson ..... Any other .....
Do you add new sand to the heaps direct? .....
Is all new sand added through the facing? .....
What per cent of work is made in green sand? ..... Dry sand? ..... Loam? .....
Is the sand cut over by a night gang? .....
Are you interested in the subject of sand conservation and reclamation? .....
Do you keep intimate record of the amount of new sand used per ton of castings? .....
Have you ever tried additions of powdered clay or other binder instead of new sand? .....
Do you maintain a test control of your sand mixtures? .....
Remarks: .....

Quite Satisfied

One of these comments came from the manager of a large machine tool foundry who claimed that he had tried various methods and various materials in keeping his sand up to standard in volume and quantity. He is satisfied that the addition of new sand through the facing is the simplest, most logical and most satisfactory method for rejuvenating the heaps and keeping them in condition. The fact that he is close to a famous sand bank and therefore can secure his sand for about $1.00 a ton probably influences his opinion to a considerable extent.

The large foundry devoted to the production of nonferrous castings in the middle west and also located favorably in relation to a sand supply states that the sand situation is well in hand and the management has neither the desire nor the inclination to try any further experimenting either with different grades of sand or with artificial binders.

During the course of a personal interview, the manager of a foundry in western New York employing 150 molders on light and medium weight gray iron castings said it would not pay him to substitute clay or any other form of artificial binder for the new sand he at present employs for that purpose. "Why should I worry about installing equipment and keeping constant supervision over the sand heaps" he said "When I can get sand delivered into my bins for $1.00 per ton?"

He admits cheerfully that if he was located in a different section of the country where his sand delivery cost might amount to $5 or $6 a ton or even less, he would be prepared to consider a change quite seriously.

Clay in Car Wheel Sand

In startling contrast to the foregoing is the practice of a car-wheel manufacturer in the same district where a proprietary clay has been used exclusively since October, 1924 to renew the bond in the sand. Car wheels are considered fairly heavy castings and must be made in a coarse open grain highly refractory sand. They must pass a rigid inspection which includes surface appearance in addition to homogeneity of structure, density, strength and accuracy of dimension within exceedingly narrow prescribed limits.

With few exceptions car-wheel foundries are arranged to make wheels according to one of two methods. In the first, or older layout the molds are placed in a circle around a jib crane, each crane and circle constituting a floor put up by a molder and helper. In the second or newer method, referred to as the *straight line* system, each floor of molds is placed in a straight single line and is served by a traveling hoist operated either by compressed air or electric current. Iron is delivered to the ends of the floors nearest the cupolas by buggy ladles running on an industrial track or by bull ladles suspended from a monorail. A similar arrangement is provided at the opposite end of the floors for conveying the wheels to the annealing pits immediately after they are shaken out. In both methods the sand is used only once in each 24 hours, but the service is so severe that a quantity of new sand has to be added to the heaps each day in addition to the new sand incorporated in each mold in the shape of facing.

The foundry referred to in the second preceding paragraph is designed and equipped on a continuous basis for the production of 225 wheels per day. The molds are assembled and poured on a conveyor which makes four complete journeys each working day. In this way only one fourth the usual number of flasks is required and consequently one fourth the usual amount of sand is sufficient. Many other advantages are claimed for this arrangement including a reduction of the number of men required to make the molds and perhaps what is still more important, the ease with which the working crew may be recruited from time to time. Under either of the usual methods, circular or straight line, the absence of a molder means an idle floor. Under the continuous system only one skilled molder is required. The remainder of the crew requires little training. Naturally the wage paid these men is lower than that of skilled molders.

Sequence of Operation

Molds are assembled on the first section of a rectangular conveyor. They are poured while they are traveling along on the second section. They are lifted in turn from the far end of the third section and shaken out over a grating in the floor. The empty flasks are placed on the fourth section and returned to the molding machines located close to the angle where the fourth and first sections come together.

Considerable experimenting was required at first to determine the exact quantity of clay necessary to keep

the sand in workable condition. An excessive quantity at first made the sand too tight. This was remedied by the addition of burned sand from the cleaning department. Satisfactory castings made under these conditions prompted the manager to develop a mixture in which all the old burned sand in the shop might be utilized. At present and for some time past an addition of 1½ per cent clay is keeping the sand in perfect condition and also utilizing all the sand that formerly was hauled away to the dump.

One of the workmen dumps clay from a small tin can one to each mold after it is poured. The can holds approximately 1 per cent of the contents of the flask. The remaining 0.50 per cent is added through the facing, which is mixed in a mill set up close to the molding machines which reduces transportation time and expense to a minimum.

Sand Handling Equipment

By spreading the clay over the upper surface of the cope immediately after the casting is poured it is claimed that the clay is in better condition to blend with the sand than if it was dumped into the sand at the shakeout station. Heat from the casting and steam rising through the cope renders the clay particularly susceptible to a close and intimate union with the sand. According to the theory on which all sand mixtures are based, a theory which has resulted from long and patient scientific investigation, the ideal sand, other conditions being equal, is one in which each grain is covered uniformly with a coating of bonding ma[illegible], usually referred to as clay.

From a hopper under the shakeout grating, the sand is carried aloft and passed through a screen and a disintegrator of the squirrel cage type. It is sprinkled with water and finally discharged into a steel hopper with a holding capacity of 40 tons or 10 per cent more than required for one complete cycle. A flight conveyor takes the sand from under the bottom of this hopper and places it in two small auxiliary hoppers, one over each molding station, one for the copes and the other for the drags. Each flask part is filled by pulling a lever which operates a gate in the bottom of the hopper overhead.

In making a comparison between the cost of operating with new sand or with a clay binder it was pointed out that the initial cost of the sand handling and other equipment did not constitute a factor. The equipment was installed and was in operation for several years before any attempt was made to substitute clay for new sand. Prices of materials and wages fluctuate from time to time. They also vary in different localities. Therefore comparative figures based on other factors than dollars and cents will convey a clearer impression of the saving effect than if a financial table was attached.

In this particular plant the cost of a ton of the clay delivered is about seven times that of a ton of sand. In contrast to this, one ton of clay has 10 times the bonding power of new sand. The bond in new sand varies from 3 to 14 per cent with an average of 9 per cent. This feature in itself indicates a source of considerable saving even where the original cost of the clay and the sand do not differ widely.

The bill for freight and unloading clay is only 10 per cent of that paid on sand. The weekly trucking bill for hauling old sand to the dump has been eliminated altogether. All the sand, old cores, scrapings from the gangway and cleaning room is returned to use. At times when the sand shows a tendency toward tightness, old burned sand from the former dump is brought in and added to the mixture.

This is the second of six articles by Mr. Dwyer on the general sand situation in the foundry. The third dealing with the cost of sand, typical deposits, freight rates and comment on the subject from various sources will appear in an early issue.

The Editors.

Foundrymen Hold Meet

The Philadelphia Foundrymen's association members were guests of the American Society for Steel Treating at a dinner and meeting held at the Engineers club on March 5. H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland, talked on malleables and their making. F. R. Palmer, Carpenter Steel Co., Reading, Pa., spoke on what happens when high speed steels are quenched.

Table III

Typical Group of Answers To Sand Questionnaire

Tons Sand	Tons Castings	Class of castings	Sand cut by machine or by hand	New sand added to heap or facing	Green sand dry sand or loam	Sand cut by night or day	Keep sand records	Ever try clay?	Maintain test control
5	15	nonferrous	by hand	in the heap	85% green	by day	no	no	no
1000	9000	gray iron	machine	in the heap	green sand	by night	no	no	no
none	30,000	gray iron	machine	clay addition	green sand	by day	no	yes	no
1500	9000	gray iron	machine	in the heap	green sand	by night	no	no	no
536	6000	gray iron	by hand	in the heap	green sand	by night	no	no	no
4800	6000	steel	machine	in the facing	70% green	by night	yes	no	yes
2100	18000	malleable	machine	heap and facing	green sand	by night	yes	no	yes
2000	12000	gray iron	machine	in the heap	green sand	by day	no	no	no
4300	36000	malleable	machine	in the heap	green sand	by night	no	yes	no
5000	22500	nonferrous	machine	in the heap	green sand	by day	yes	no	no
3200	18000	gray iron	both	in the facing	30% green, 70% dry	by day	yes	no	no
2000	6000	gray iron	both	heap and facing	95% green, 5% dry	by day	yes	no	no
.....	37500	malleable	both	.....	green sand	by night	yes	yes	yes
300	1500	gray iron	machine	heap and facing	95% green, 5% dry	by night	no	no	no
2000	12000	gray iron	machine	heap and facing	green sand	by night	no	no	no
1200	18000	gray iron	machine	in the heap	green sand	by night	no	no	no
800	4800	gray iron	by hand	in the facing	30% green, 70% dry	by day	yes	no	no
700	5400	gray iron	by hand	in the heap	green sand	by day	no	no	no
400	6000	gray iron	by hand	in the heap	green sand	by night	no	no	no
2000	30000	malleable	both	heap and facing	green sand	by day	no	no	no
1800	9000	gray iron	machine	facing	green sand	by night	yes	no	no
24000	45000	steel	both	facing	85% green, 15% dry	by day	yes	yes	no
110	1800	gray iron	by hand	heap and facing	90% green, 10% dry	by day	no	no	no
2100	13500	gray iron	by hand	in the heap	green sand	by night	no	no	no
5000	37500	malleable	machine	in the heap	green sand	by day	yes	no	no
200	2700	gray iron	by hand	heap and facing	green sand	by night	yes	no	no
800	9000	malleable	machine	heap and facing	green sand	by night	no	no	no
40000	60000	steel	both	in the facing	90% green, 10% dry	by day	yes	no	no
820	6000	gray iron	both	in the heap	green sand	by night	no	no	no
3600	24000	gray iron	both	heap and facing	green sand	by night	yes	yes	no

Ancient Methods Prevail in Central China

By Frank A. Foster

Fig. 1—Above—Cast Iron Pots Are Poured in Porcelain Long-Life Molds. Fig. 2 — Right—These Molds Are Swept by Rigging Which While Crude Is Surprisingly Accurate

CAST iron cooking pots which were mentioned in the concluding portion of the previous article, are exceedingly thin. Fig. 3 was arranged to show this property of these really remarkable castings. A section of a 3-foot cooking pan was placed against the back of a ruler, alongside a newly coined 10 cent piece. It will be observed that the cast iron section is slightly thinner than the dime and is only slightly in excess of 1/32-inch in thickness. Despite this fact, the grain structure is fine and gray and with no indication of the crystalline, white fracture of chilled metal. Probably this particular cooking pan had been cast in one of the permanent molds mentioned further along in this article.

The pans made in the iron mining region are cast in loam molds. In some places the molds are buried in the ground. In this method of casting the gate is sheared from the bottom of a kettle while it is still red hot in the mold. A shovel serves for this purpose. The iron as made in the smelting furnace is poured at once into the molds from the crucibles.

At Paotingfu (pronounced Boughding-foo), in Chihli province, similar pans are cast in permanent molds. To make a permanent mold a highly refractory material, which will also give a smooth surface, must be used. This refractory material the Chinese foundryman has found and always makes for his own use by pounding up old pieces of pottery to a fine dust.

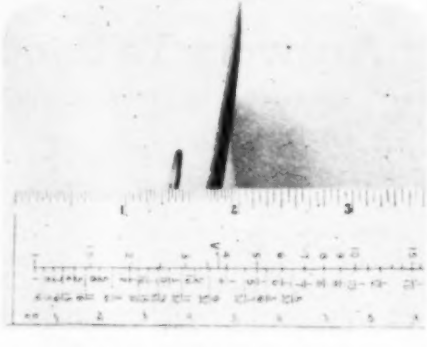


Fig. 3—Cooking Pots Several Feet in Diameter Are as Thin in Section as a United States 10 Cent Piece. The Metal Give No Evidence of Being Chilled

This is accomplished by pulverizing it in a cast iron mortar with ball hammers or pestles, similar to the age-old method followed by druggists in powdering dry chemicals.

Fig. 2 shows the apparatus for sweeping up a pan mold. The tools are simple and crude but quite efficient. The sweep templets are shaped carefully and sized to give the required thinness to the metal space in the mold and, at the same time, make the matching surfaces of the two parts of the mold. The refractory material is mixed quite stiff and spread over cast-iron spider forms to give the necessary rigidity. The molds are amply vented. The vent holes are clearly seen in Figs. 1 and 10. These molds are baked and before starting a day's run they are pre-heated. During the run they are given frequent inspection and washes with clay water.

Fig. 1 shows one of these molds being poured. Bars are inserted in holes in the cope on which weights are placed to prevent the cope from floating up. Large molds are poured from two ladles at the same time through the same gate as shown in the illustration. The workmen become expert in pouring the exact amount necessary without leaving any sprue. The iron cools quickly. In a minute or so the cope is lifted slightly to admit air, which assists in cooling. The body of the pan still is red hot when the cope is lifted off and the center of the bottom, which is a little thicker, has just barely set. If too much iron

has been poured, the surplus is shaved off neatly with the blade of a shovel. If too little has been poured, the hole is filled up by dipping some iron from the ladle with an iron spoon and pouring it on. The pan is now lifted off with a 3-pronged hook and the mold surfaces examined for any incipient cracks which, if they appear, are given a wash of clay water and the mold is closed ready for another pouring. These molds are capable of making a great many pans and kept at work all day.

Fig. 4—Above—Simple Cupolas Melt a Mixture of Pig Iron and Broken Scrap Castings, Employing a Blast from a Wind box of Primitive Design. Fig. 5—Inset—Larger Cupolas Are Built in Three Sections

Small cast iron charcoal stoves also are made in permanent molds. Fig. 10 shows such a stove, the mold and the molder. These stoves are cast integral with the legs and arms for supporting a cooking pan. The metal in these also is extremely thin.

The usual type of Chinese plow is a light affair of wood with a small thin point of chilled cast iron slipped on the end of the share beam. These are cast in permanent molds and the chill given by using a cast iron core for making the hollow part. These molds are left open at the top as shown in Fig. 12, which shows the molds ready to be poured.

This process of casting extremely thin iron might be used to good advantage in America in the manufacture of many small, thin articles if the iron could be supplied with the proper proportions of phosphorus.

Chinese Cupolas Are Simple

The type of cupola used by the Chinese is shown in Figs. 1 and 8. This type probably has been in use by them for at least a thousand years or more and is used in all parts of the country. Even in the larger ports where foreign influence has modified Chinese custom to quite a noticeable extent, these older types of cupolas are encountered in a majority of shops. Only in a few places are foreign style of cupolas to be found.

These cupolas usually are made to tip for drawing off the melted iron. They are made of two sections, the lower one being a bowl shaped piece lined with fire clay and mounted on trunion bearings, as shown in Fig. 6. A tilting lever is inserted in a socket at the back. The upper section is a cylindrical piece lined with fire clay and luted to the lower piece. A tuyere opening is made in the side and sloping toward the bottom. Fig. 9 shows the top section inverted. This hole is located to come directly over one of the trunions. The tuyere pipe comes just flush with the side of the cupola, but does not enter it. When the cupola is tipped the blast is automatically shut off. Figs. 4 and 8 show the cupola being tipped for pouring off. Figs. 1 and 4 also show the type of ladle used

Larger cupolas are made in three sections, as in Fig. 5. The three-section cupolas are not tilted for pouring off. These usually have the tuyere pipe entering from the back side. The tuyere pipe is provided with a covered opening close to the cupola through which the charge may be poked in the event of its becoming clogged.

Elevate Charging Floor

The charging is done by tossing in the materials from the portable platforms as seen in Fig. 5. In laying in the first charge, the lower section is carefully packed before the next section is put on. The hooks and loops on the sides of the sections are for inserting poles for lifting the sections off. These tall, three-section cupolas seldom are seen except in the larger ports where electric power now is available for driving the blast machinery.

The most commonly used blast apparatus is the primitive *feng hsiangze* (pronounced fun shanzer), or windbox, which has been in use in China for a wide variety of purposes from time immemorial. These range from the tiny ones made from a section of bamboo for blowing a tinker's soldering fire, a little larger type for a blacksmith's forge fire or the kitchen stove, up to the large ones like those shown in Figs. 4 and 6. The construction is about the same in all of them, usually of a rectangular box shape, closed at the ends except for the openings for the valves at each end as shown in Fig. 11. A wooden piston, *B*, is fitted to slide freely and is cut out to fit around the valve passages leading to valves *E* and *F*. The edge of the piston is grooved and packed with feathers glued on around the periphery to make it air-tight and permit it to slide freely. Attached to the piston are

Fig. 6—Below—Crude Windboxes Employed in Many Chinese Foundries Are Operated by Two Men Alternately Pulling and Pushing a Cross Head Provided With Suitable Valves. The Bottom Section of a Cupola Is in the Foreground

two bars, *C*, with a cross handle at the outer ends. Suitable clapper valves hung on leather hinges are located in each end of the air passage. Blast is obtained from both the forward and the backward stroke of the piston. The dovetail slide, *H*, is for getting at the inside of the box. The discharge nozzle is at *G*.

For a two-part cupola such a box would be about 4½ feet long and the area of the piston about 750 square inches. The stroke is so long that the four men at the handle have to take steps forward and back to make it. At the end of each stroke they give a sudden jerk to insure the valves closing quickly. Fig. 4 shows one of these windboxes in place for service.

Figs. 7 and 8 show a crude rotary fan driven by handpower and producing speed by a series of rough cast iron gears and a belt. This is an intermediate step from the crude *feng hsaingze*, to the electrically driven rotary blast fan found in some of the larger port foundries. The windboxes give a good blast and have the advantage of being comparatively cheap to make and maintain. Where they are used labor is cheap.

Flasks Are Rare

Wood is scarce in many parts of China and relatively expensive. For that reason it is not used extensively for making flasks. Many molds are made in the ground, using only a cope flask. After bedding the pattern in the ground, the cope flask is placed and stakes driven into the ground as guides for replacing it. Such a mold is seen in Fig. 14. The Chinese make bedsteads of foreign type from wrought iron pipe to which the various joint and ornamental parts are attached by casting iron around them. The pipe is laid on the ground and located by stakes at the sides and end. At the places where casting it to be done, the pipe is surrounded by dry-sand molds located by stakes driven into the ground. This is often an apprentice's work.

Another method for doing this work was seen in a Shanghai native foundry where the cast iron parts are made in cast-iron molds instead of dry-sand. The iron for these castings is melted in small crucibles set in furnaces made by lining old iron barrels with fire clay. The molds are hinged so they can be wrapped around the pipes and quickly removed as soon as the casting sets so as to prevent excessive heating of the mold. The resulting castings are quite smooth and sharp in detail. Typical permanent iron molds for this class of work are shown in Fig. 13.

Numerous foundries in and around Shanghai use all kinds of equipment from the crudest ancient types to the most modern. Machine tools, steam and gas engines, printing presses, textile machinery, electric motors and a great variety of other machines now are built extensively in that vicinity. In this work some foundries prefer to use pig iron brought out from England or other European countries rather than use the native iron, especially where large and important pieces have to be cast. For smaller work some use the iron from Ping Ting Chow, while others prefer the pig iron from the great Han Yeh Ping smelters near Hankow.

Handles Large Work

The Kiangnan Dock and Engineering Works, in Shanghai, is equipped for producing all kinds and sizes of cast brass, bronze and iron work. Fig. 15 shows an electric furnace which this shop built and now is operating. The view was taken before the completion of the work. This is probably the first electric melting unit built in China. This plant is a government establishment under foreign supervision and has a fine equipment of machinery for handling all kinds of work, including large marine engines, steamships, etc. It has built several large transports for the United States government and has constructed several large diesel engines.

There are several technical and trade schools established in various parts of China in which foundry practice is taught by practical work. Fig. 16 shows students engaged in such work. The Yu Te middle school, at Paotingfu, where these photographs were taken, is a private institution which is doing unusually good and practical work. While it does not make a pretense of being a highly developed technical school, it gives its

Fig. 8—Below—Pouring a Simple Cupola

Fig. 9—Inset—Inverted Top Section of a Two-Piece Cupola, Showing the Tuyere Opening

Fig. 7—Above—Native Made Blowers Sometimes Are Driven by Four Men Turning Cranks Actuating a System of Gears and a Belt Drive

Fig. 10—Castings for a Thin Walled Charcoal Stove, Used with the Cooking Pots Described, Also Are Made in the Long Life Porce'ain Molds. Note the Manner in Which the Molds Are Vented

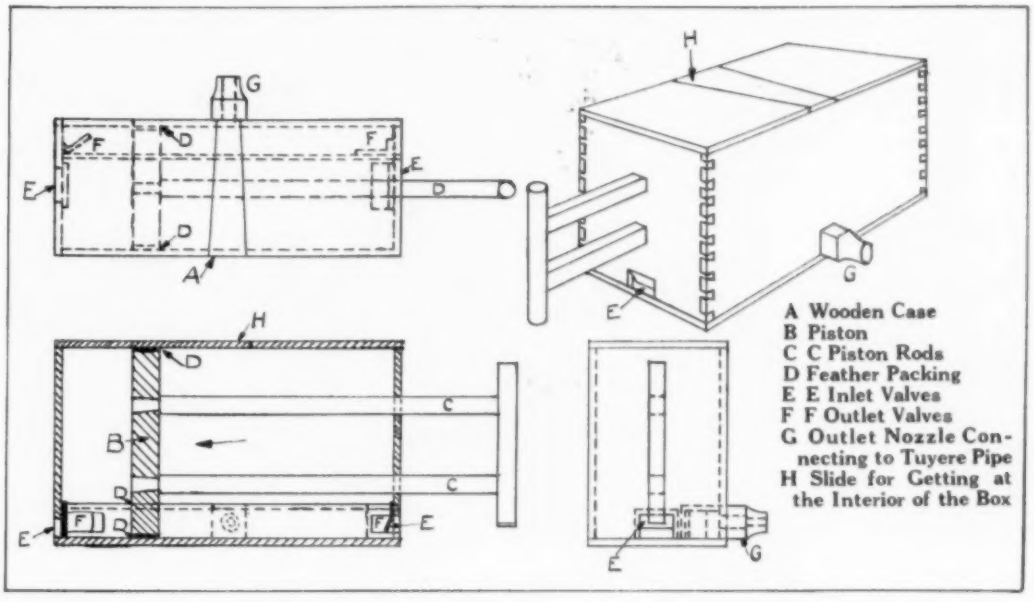

A Wooden Case
B Piston
C C Piston Rods
D Feather Packing
E E Inlet Valves
F F Outlet Valves
G Outlet Nozzle Connecting to Tuyere Pipe
H Slide for Getting at the Interior of the Box

Fig. 11—A Simple Type of Windbox, Shown in Perspective, Plan and Section at the Left, Is Used in a Variety of Metal Working Services

students a thorough practical training in various mechanical lines and educates a class of young men much needed for developing the resources and industries of a growing country.

In spite of her great age and in spite of certain internal weakness and strife now going on, due principally to the great transition from the old condition to the new, China is developing in many ways and needs trained metal workers. An interesting and valuable feature of the instruction at Yu Te middle school is that the work in the shops and foundry is as much on a commercial basis as possible.

Fig. 12—Above—Chilled Iron Plow Points Have Been Cast in China for Centuries. A Simple Two Part Mold and a Metal Core Are Employed.

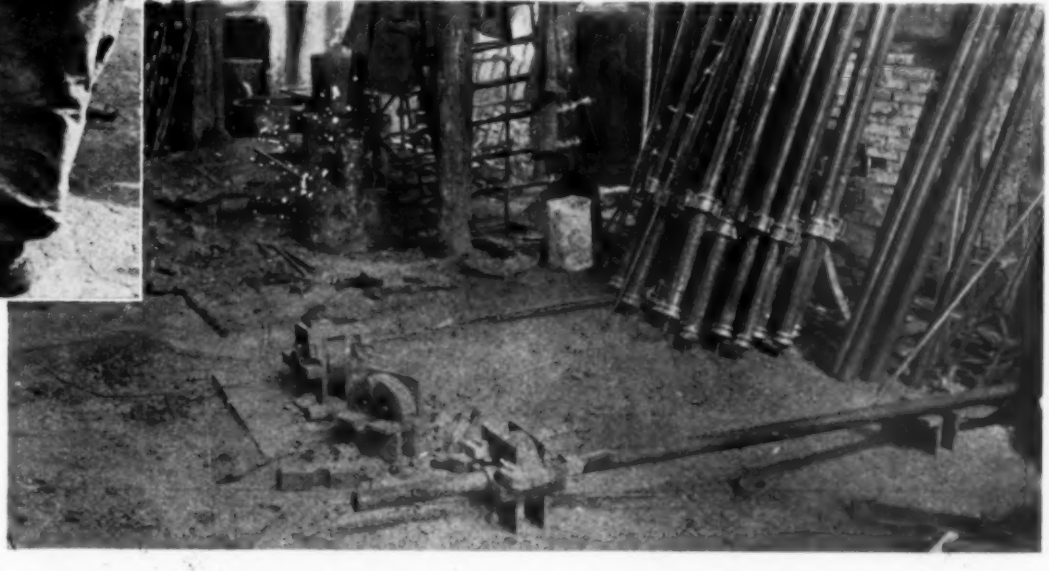


Fig. 13—Right — Permanent Molds Are Used for Fittings on Wrought Iron Pipe Bed Frames

An interesting and practical application of their work in which the foundry was an important factor in assisting in the economic welfare of that part of the country was made a few years ago. A severe drought was prevalent in Chihli province. Many of the farmers there are dependent on wells for a supply of water for irrigation of their crops. The Red Cross society has funds for relief of the distress and undertook to dig more and deeper wells. The pumps used by the farmers are crude. Many are merely a windlass with a bucket hung on the end of a rope. Others are constructed with metal parts, including pin-toothed gears which are all forged iron. These are expensive for the poorer farmers. The students redesigned the animal driven pump, replacing the wrought iron gears with properly designed cast ones and made a pump that cost about half as much as the old style and was far more efficient. They made hundreds of these and were largely instrumental in relieving a great distress, proving to the people that the new methods being taught in the school were of a practical value.

It is probably quite natural that in adopting many of the new ideas some important features are overlooked or neglected. In the case of iron casting, for example, there is a tendency to neglect proper venting of molds, reculting often in blow holes and poor castings. Often the mixtures are not of the best and the iron not as strong as it might be made. However, this often happens in some other countries. There are not many Chinese foundries where there is any systematic tests made of the iron, either before or after casting, but the writer found one Chinese managed foundry in Tien-

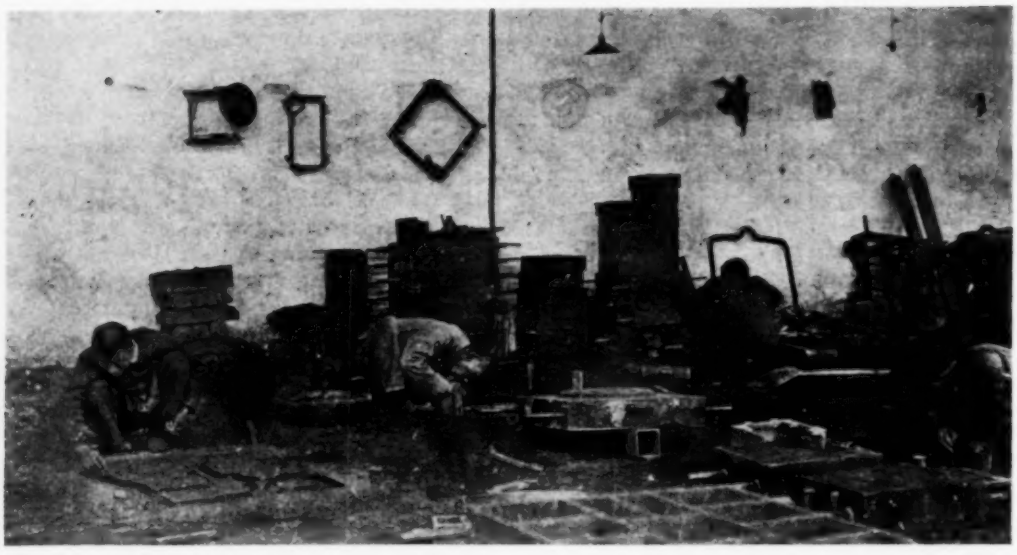


Fig. 14—Molding Loom Frames, Bedding the Drag Half in the Floor and Using a Simple Cope, Located by Stakes Driven in the Ground

tsin that claimed to keep a daily record of the quality and quantity of both the iron and fuel used. Some foundries report a loss of as much as 30 per cent in poor castings.

An interesting observation was made in Japan by an acquaintance of the writer. Being much interested in foundry practice, he visited many foundries in Japan. In the course of his travels he became acquainted with a Japanese professor of engineering at one of the technical schools, who had had a little training in an American technical school. The professor was much interested in airplanes and had constructed one of his own design, including the engine. This engine he exhibited with a great deal of pride. The American noticed several rather bad blow holes in critical parts of the engine cylinder casting and, out of curiosity, began to probe to see how deep they penetrated. Taking off his scarf-pin he found he could not reach the bottom of the holes with that. One wonders how far an aviator would get with an engine built of such poor iron.

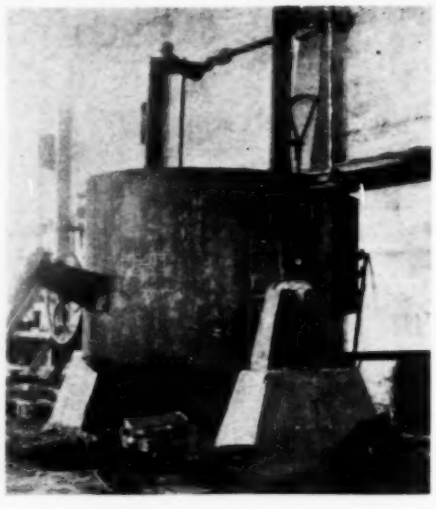


Fig. 15—Electric Furnace Under Construction at the Plant of the Kiangnan Dock and Engineering Works, Shanghai

Foundries in China, today, in a few places along the coast, show the effect of contact with the methods of more highly developed countres; but, owing to the still limited means of communication and transportation, only a small dent has been made in the centuries-old customs and methods. The influence from the outside has touched long the eastern coast line and is slowly penetrating inward. Therefore, it is interesting to note these older customs and methods still in vogue before they become changed by contact from the outside. The untouched parts apparently are about in the condition of Europe of two hundred years ago.

Fig. 16 — Chinese Students in Technical Schools Show Unusual Proficiency. They Prefer to Work on the Floor Rather than at Benches

Describe Loam Molding Methods

By
Ben Shaw and James Edgar

PART VIII
Various Methods and Devices Adopted to Make Cores for Irregular Shapes

FOUNDRYMEN not familiar with loam molding methods entertain the idea that loam shapes are confined to those which may be formed around horizontal or vertical spindles. While it is true that the majority of loam jobs fall under that heading, still there are a great many other jobs made in loam without the use of spindles. In fact the number of ways in which loam molding may be applied only is limited by the molder's ingenuity. Sometimes this ingenuity is exercised at the expense of economy. Exceedingly tricky and difficult loam molds are employed where the casting might be made more cheaply from a proper pattern in a dry sand mold.

Where not only the strickles but a great part of the pattern have to be made of wood and where the attendance of a patternmaker is required in the foundry all or nearly all the time the mold is under construction, the loam method usually is more expensive than the dry sand method. Occasionally, as pointed out previously, conditions are reversed. It is not necessary to renew the pattern parts and a careful molder may set the parts on a second and subsequent molds as accurately as they were set by the patternmaker on the first.

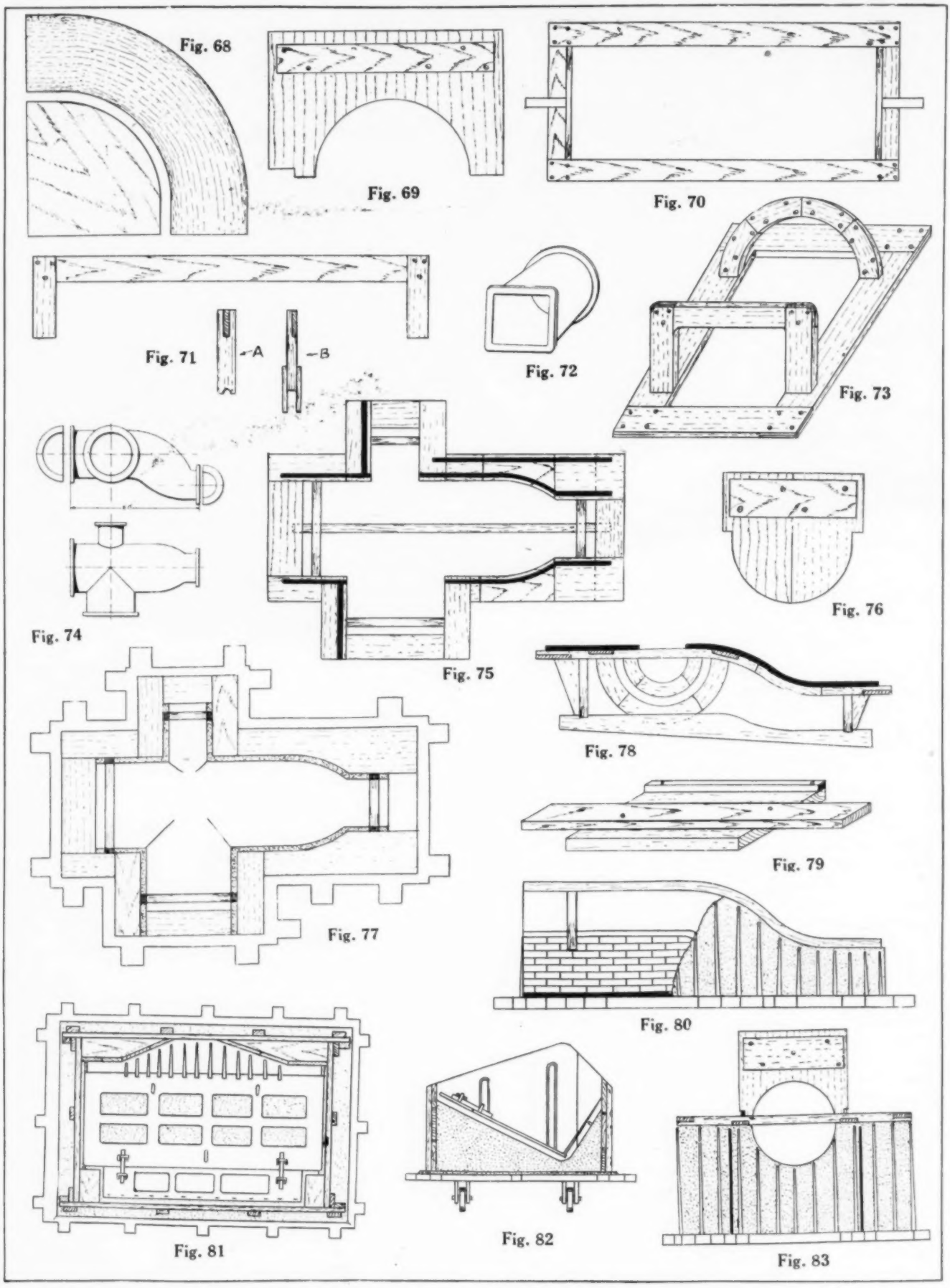
Several different processes may be employed for making cores similar to that shown in Fig. 68. One is to make a guide of iron or of wood and attach it at a suitable place on the plate. This guide bar may be ¾-inch thick and may vary in width from ¾ to 1½-inches. In the illustration, a board ¾-inch thick is shown covering the entire corner of the plate with the curved edge serving for a guide for the core strickle Fig. 69.

Guide Bar Shapes Core

Where either style of guide is used a covering of loam is placed on the approximate area to be covered with the half core. A suitable grid is bedded down into the loam and then the remainder of the half core is built approximately to shape with loam that has been stiffened by the addition of dried portions. The board is worked over it roughly to preserve the general shape as the building progresses. A check cut in the lower corner of the board fits against the guide. In finishing the core the loam is thinned and a final coating applied. Where the two halves of the core are symmetrical the same guide may be used for the second half. Where a right and left half are required the guide bar either may be reversed or a second guide supplied with the necessary modification. After the two halves are dried a vent channel is cut in the joint if provision has not formerly been made with ashes in the body of the core. The entire core then is assembled, calipered for size and shape and afterward taken apart for an application of claywash to the joint to serve as a binding agent. Usually large cores are bound with several strands of wire or are bolted through suitable lugs in the arbors. After receiving a coating of refractory wash and a final drying the core is ready to be placed in the mold.

A rig for sweeping a semicircular core, for example a D-shaped bush core, is shown in Figs. 70 and 71. Instead of the half height board shown in Fig. 69 the frame and longitudinal board shown in Figs. 70 and 71 are employed in this instance. An end view of the board is shown at *A* Fig. 71 with an alternative method for fitting the ends over the spindles shown at *B*. A small wood spindle is fastened at each end of the frame Fig. 70 and the swinging board is maintained in a central position while it is traveling over the semicircular end pieces.

This is a more accurate method of sweeping a core of this kind than simply trusting to the end guides. It is more convenient than a half height board for making large cores, es-



FIGS. 68-83—FRAME PATTERNS AND AUXILLIARY EQUIPMENT, PLATES, ARBORS AND SWEEPS EMPLOYED IN MAKING LOAM CORES FOR IRREGULARLY SHAPED PATTERNS WHERE THE NUMBER OF CASTINGS ON ORDER DOES NOT JUSTIFY THE EXPENSE OF A FULL SET OF PATTERNS AND COREBOXES

METHODS FOR ANALYZING FERROALLOYS

FERROSILICON

Determination of Silicon by Fusion with Sodium Peroxide and Dehydration with Hydrochloric Acid

Transfer 0.5000 g. (use 0.4000 g. for 90-per-cent silicon) of the finely powdered sample (passing a No. 150 sieve) to a 50-cc. pure iron crucible made from No. 20 gage (0.32 in. thickness) ingot iron, add approximately 13 g. of sodium peroxide. Mix *thoroughly* with a platinum or iron rod and carefully clean the rod of adhering particles by scraping with another rod. Cover the mixture with a layer of about 2 g. of additional peroxide. Heat the crucible and contents on a hot plate for 5 to 10 minutes to expel any water in the peroxide which would cause spattering in the subsequent fusion. Carefully fuse over a low flame by holding the crucible with a pair of tongs and slowly revolving it around the outer edge of the flame until the contents have melted down quietly. When the fusion is molten, rotate the crucible carefully to stir up any unattacked particles on the bottom or sides, the crucible and contents being maintained at a low red heat. Just before completion of the fusion, which requires only three or four minutes, increase the temperature to bright redness for a minute. If the reaction has proceeded too violently, due to too rapid heating, to the use of insufficient sodium peroxide, or to the lack of thorough mixing, appreciable loss will occur and the work should be repeated.

Cover the crucible and allow it to cool until the fusion has solidified, and tap the crucible, while still warm, several times on an iron plate, which will loosen the fused mass in a solid cake. When the crucible and cake have cooled completely, transfer the cake to a large (275-cc.) gold or preferably platinum dish. Cover the dish with a clock glass and cautiously add 50 cc. of cold water. When the reaction ceases, wash the small amount of adhering matter in the crucible into the dish with a little water. Cool the solution and carefully add an excess of hydrochloric acid. Evaporate to dryness, preferably on a steam bath, but do not bake at a temperature above 110 degrees C. If platinum or gold dishes are not available for solution of the fused cake, the latter can

Abstracted from Proposed Tentative Methods of Chemical Analysis, American Society for Testing Materials, 1925.

(*Concluded on Data Sheet No.* 614)

METHODS FOR ANALYZING FERROALLOYS

FERROSILICON

(*Concluded from Data Sheet No.* 613)

be disintegrated with water in a pure nickel dish and the contents then transferred to a porcelain dish containing sufficient hydrochloric acid to provide an excess of acid. It is not desirable to dissolve the fusions directly in porcelain, because of the action of the alkaline solution.

When the residue is dry, allow the dish to cool. Add 10 cc. of hydrochloric acid (sp. gr. 1.13), cover the dish and heat gently for a few minutes. Dilute with 100 cc. of hot water, digest for a few minutes and filter through an 11-cm. paper. Wash about eight times with hot 5-per cent hydrochloric acid, three times with warm 5-per cent sulphuric acid and a few times with hot water. Reserve this paper until the second evaporation has been completed.

Evaporate the filtrate to dryness and bake the covered casserole or dish at 110 degrees C. for one hour. Heating at a higher temperature is unnecessary and also disadvantageous. Cool, add 10 cc. of hydrochloric acid (1:1), digest on the steam bath for ten minutes, add 100 cc. of warm water, filter immediately and wash about eight times with cold 1-per cent hydrochloric acid, twice with cold 5-per cent sulphuric acid and a few times with cold water.

Place the paper and silica from the *second* dehydration in a large partially covered platinum crucible and char the paper without inflaming. Add the paper containing the silica from the first dehydration, char as before and then ignite carefully until the carbon has been burned off. Great care should be exercised in igniting the papers as the current of air produced by a burning filter is sufficient to carry finely divided silica out of the crucible. When the carbon of the filter paper has been burned completely, gradually heat the tightly covered crucible to the full heat of a blast lamp and continue the heating at 1050 to 1100 degrees C. for 25 minutes. Cool in a desiccator, weigh and check for constant weight by ten minutes' additional heating at the above temperature. Add sufficient sulphuric acid (1:1) to moisten the silica and then 15 to 20 cc. of pure hydrofluoric acid (48-per cent). Evaporate to dryness, ignite and weigh. The loss represents silica which contains 46.76 per cent of silicon. A blank, not omitting the same amount of hydrofluoric acid, should be carried through all stages of the operation.

NOTE

The silica remaining in the filtrate after the second dehydration is practically negligible, averaging about 0.0006 to 0.0010 g. in hydrochloric dehydration and 0.0010 to 0.0015 g. in sulphuric dehydration.

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

THE FOUNDRY DATA SHEET, MARCH 15, 1926
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Around the World with The Foundry

Little Journeys to the homes of our readers

Philippine Islands

STANDING on the bridge of his old flagship Olympia 28 years ago Admiral Dewey led the Asiatic squadron of the United States navy out of Hong Kong and entering Manilla harbor on May 1, 1898 destroyed the Spanish fleet without suffering the loss of a single ship or man in his command. It was the first decisive action in a war which a few months later deprived Spain of the greater part of her one time vast colonial possessions held since the days in the 16th century when an expedition under Villabos landed at Cebu and named the group of islands in honor of the heir to the Spanish throne afterward known as Phillip II.

The population of 8,000,000 is made of 30,000 Americans and Europeans, 100,000 Chinese and the remainder are of the native Malayan race of whom nearly 1,000,000 still are in a wild state. Immense quantities of hemp, sugar, coffee, cocoanuts, tobacco and indigo are exported, the relative quantity of each being in the order indicated. The casting industry has not been developed to any great extent, but 18 foundries are listed as operating in the islands and THE FOUNDRY is a welcome visitor twice a month to nine of the principal plants.

"Wherever metals are cast you'll find THE FOUNDRY"

pecially where the core presents changes in diameter or where facings or other loose pieces have to be incorporated in the surface of the core. The position of these various pieces may be marked on the sweep. The form of grid for this core is similar to that described elsewhere for a half core and is made up of a skeleton frame provided with a row of long curved prongs on each side.

Various Methods

A type of exhaust pipe frequently seen in the foundry is shown in Fig. 72. It is rectangular at one end and circular at the other end with the contour of the pipe gradually changing in shape from one end to the other. Several methods are available for making the pattern for this pipe. Either a solid pattern or a skeleton shell pattern may be employed. The frame pattern shown in Fig. 73 probably is the cheapest and most convenient. It will serve for both pattern and corebox, or, to be strictly accurate it will serve as a guide in making the mold while the core is built inside the mold. The mold is strickled to shape and after the loam has stiffened, a thickness of loam equal to the desired thickness of the casting is applied to the face. The core then is built up to the joint line and a second half frame is fitted to the first half. The core is built up the remainder of the distance and after it has stiffened a thickness is applied to correspond to the thickness of the casting. The second half of the mold is built over this improvised pattern and the subsequent operation of parting the mold, stripping the core, finishing, assembling and pouring the mold are the same as described previously.

Certain patternmaking methods automatically are ruled out where speed of production is the paramount feature. The same holds true on many large one-off jobs. Consider for example the large four-way condenser pipe shown in Fig. 74. A full pattern and corebox for this casting would cost a considerable sum besides consuming a great deal of valuable time. A framed skeleton may be used with the aid of a few strickles to serve both as pattern and corebox.

This method is particularly suitable for large cylindrical castings, retorts, large pipe bends, special pipe shapes, etc., poured in a horizontal position and castings in which a slight variation from absolute accuracy in shape or metal thickness is not a condemning feature. This method may be employed either with dry sand or loam. Where the joint of the mold is straight the work is comparatively simple, but the patternmaker is confronted with a fairly difficult job where a curved joint is required.

Iron Guide Bars

The shape of the under side of the frame corresponds to the joint line of the mold which of course is taken along the center line of the casting. The frame is assembled and checked on suitable supports erected on the layout board or on the floor of the pattern shop. The curved parts either are made from two thicknesses of segments, or, from one thickness pieces held in place by hardwood battens. The inside edges of these battens are adjusted to serve as a guide for the strickles used in shaping the mold and core.

Sometimes ⅝-inch square steel or iron bars are bent to the required shape and take the place of the hardwood battens and serve both as battens and guides. They are screwed to the frame in the manner shown in Figs. 75 and 78 through suitably drilled holes. After the frame has been half lapped and assembled on the supports, the correct outside shape of the pipe is formed inside the frame.

Several details in patternmaking and molding might present nothing out of the ordinary to the experienced workman, but since they might prove pitfalls for the unwary or inexperienced workman, it is felt that no apology is required for reference to them in detail in the present series. Fully as much if not more skill is required in improvising a pattern and mold rig of this kind than in making a first class orthodox pattern and corebox and molding the job in green or dry sand.

By referring to Figs. 75 and 77 it may be noted that the various openings in the frame extend several inches beyond the flanges. The object of course is to provide room for sweeping the core prints. Two guides are required in sweeping the top shape of the pipe. They are set most conveniently about ¾-inch back from the inner edge. The half flanges secured to the under side of the frame are formed of segments with the inner semicircle cut to the size of the core.

Detachable Flanges

Screws which hold the flanges in place are accessible from the upper side of the frame. Sometimes a temporary stay as shown in the center of Fig. 75 may be attached to hold the flanges in their proper position. Experienced patternmakers can furnish certain parts of the pattern so that the molder may get an early start and then furnish other pattern parts as they are required. In many cases, particularly where the patternshop is close to the foundry, the patternmaker may find it necessary to spend considerable time in the foundry, assembling pattern parts and taking them apart to suit varying conditions as the work progresses.

To provide a bearing and guide for the sweep Fig. 76, the filling in piece Fig. 79 is placed temporarily in the gap forming one of the branches. A similar filling in piece, but differing in size is placed in the opposite gap. These pieces are the same thickness as the frame and may be fastened either with pocket screws or with a batten which extends across the piece on both sides as shown in Fig. 79. The batten is provided with suitable dowel pins or marks so that the piece may be removed and replaced as many times as necessary.

Half height sweeps are made similar to that shown in Fig. 76 and in sizes corresponding to the diameters of the several branches on the pipe. Attention is directed to the direction of the grain in the wood. Patternmakers sometimes mistakenly cut these sweeps with the grain running at right angles to that shown. It is scarcely necessary to point out that the soft wood along the bottom or cutting edge wears away rapidly and the wood is cracked and broken easily.

These boards are cut to the full outside size of the pipe and are provided with a check or shoulder on each side to ride on the frame. The full half circle projects below the lower face of the frame since this face represents the center line of the casting.

A number of special strickles known as *making-up* are required on jobs of this kind where the diameter of the pipe gradually changes between given points. A second set of half flanges are required for the top part of the pattern. They are cut full size since the frame is removed before they are placed in position.

Foundry Equipment

The first essentials in the foundry for making this casting are a suitable core grid and top and bottom plates. A typical bottom plate is shown in Fig. 77. The shape is not arbitrary and many of the minor details depend on the personal preference of the molder. An over size plate is preferable to one in which facilities are skimped. The upright bars known under various names as

rods, prongs, dabbers, prickers or gaggers, may be cast approximately to the correct length by placing a mark on the stick employed to prod the holes in the face of the plate mold. They are better long than short, because the molder easily can break a bit from the end of any that project too high.

Circumstances which vary with nearly every job influence the molder in his choice of a method for setting the frame. He may place the frame on temporary brick supports and build up to it, or, he may build the greater part of the mold simply by estimate and measurement and adjust the frame just before the last course of brick is laid. It is advisable to use plenty of loam between the courses and also between the individual bricks. After the building has assumed approximately the correct shape the frame is bedded in a generous thickness of loam. About an inch clearance is left between the brickwork and the sweep for the loam covering and the same clearance or perhaps a little more is left between the bricks and the face of each flange inside and outside. The frame is weighted to hold it in position while the sweeps are being used.

Making the Core

An elevation of the bottom part of the mold partly in section is shown in Fig. 80 while the general appearance of the prepared half corebox with the frame in position, is shown in Fig. 77. This corebox is formed, as explained in previous articles, by sweeping a thickness of loam corresponding to the thickness of metal in the proposed casting, on to the face of the mold. When this has stiffened it is dusted with parting sand and then a thickness of loam destined to form the lower face of the core is spread over the surface. The main grid is bedded into this loam. Circumstances will decide whether to make the grid in one piece or to cast the parts separately and fasten them together. If only one casting is required a single piece arbor will serve since it may be broken during the cleaning of the casting. Some men prefer to incorporate iron or steel rods in the arbor, while other men use a curved or even a straight *prodder* to form these bent members designed to carry the body of the core. One advantage of the wrought iron or steel rods is that they easily are placed in the arbor mold and afterward easily are bent to the required shape. The core is made up of a 3 or 4-inch thickness of loam filled with ashes. An end view of the method employed in forming the top half of the core is shown in Fig. 83.

After the loam in the top of the core has stiffened sufficiently an additional thickness of loam corresponding to the thickness of metal is swept over the surface. The frame then is removed and the upper half flanges are adjusted in place on the lower halves through suitable dowels and dowel pins. It is advisable to test the accuracy of the flanges by a square set up on the joint, or by a suitable bevel if the flanges are designed to lie at any other than a 90-degree angle with the main center line of the casting.

Building the Cover

Work on the cover is taken up after the joint and the surface of the loam pattern has been dusted with parting sand. The skilled loam molder usually contrives to build a considerable part of such a cover by introducing smaller grids to support the brickwork before he finally sets the cover plate in position. Suitable marks are placed on the outside of the mold in several places on the upper and lower sides of the joint line to serve as guides in replacing the top part of the mold on the bottom part after they have been taken apart and finished. The mold is taken apart, finished, blackened, stoved, reassembled and cast after the manner previously described.

Plan and end section of a somewhat different core and corebox are shown in Figs. 82 and 83 respectively. Designing the necessary rigging for a large core of this kind which may be 8 or 9 feet in length and proportionally heavy, requires a reasonable degree of knowledge, skill and forethought. Snugs are cast on the ends of the core plate. They project beyond the ends of the core so that the molder may provide additional support for the core and thus relieve the pressure on the prints.

The main objection to this method is that the corebox must be cut to clear the lugs, but this really is an insignificant point when compared with the many advantages gained. This method is not shown in the illustration. The plate in this case is made in two parts and fastened together by 1-inch square bars wedged under suitable staples cast in each section of the plate. This form of construction frequently is employed since it greatly facilitates removal of the plate when cleaning the casting.

Obviously, cores of this character would be awkward to handle in a green state, or to dry on the floor or in a pit. Usually a core of this kind is built on a bogie as shown in Fig. 82. A loam bearing first is struck level on the plate for the reception of the corebox. The inside of the corebox then is built up approximately to the right shape with brick loosely laid and covered with floor sand. The proper shape is formed by a strike guided by suitably shaped pieces attached to the ends of the corebox.

Filled with Ashes

The claywashed grid is bedded into a thickness of loam laid in the usual manner on the prepared sand bed. Bricks and loam may be used in building the core. However, if long dabbers or rods around the edge of the lifting plate form part of the equipment, the bricks may be omitted. A shell of loam a few inches thick is sufficient. Pieces of dried loam are incorporated in the shell to hasten the drying and the interior of the core is filled with ashes. A thickness of 5 or 6 inches on the top is made up with loam. This top course will sag, therefore it is made up higher than the top of the corebox and allowed to stiffen to some extent before it is strickled to shape. The upper gable ends of the corebox serve as guides for the long strike used in forming the top surface of the core.

Many other types of irregular shaped molds and cores will be encountered in the foundry, but the molder who has grasped the main principles involved will be in a position to adapt them to suit any given set of conditions at short notice.

Low Carbon Steel Soft

Question—Is there a process of making steel so that it does not need to be annealed, after it is cast, to make it soft? I believe it is done by melting mild steel and adding aluminum.

Answer—Frequently steel castings with 0.25 per cent carbon or less are not annealed and are reasonably soft. A still softer metal is made in the converter and contains less than 0.1 per cent carbon. Small amounts of aluminum are added to this in the ladle. Occasionally pieces of aluminum are also put in the mold, and the steel flowing over these small pieces of aluminum melts and absorbs it, and it then serves to keep the steel deoxidized. The amount of aluminum thrown over the ladle is relatively quite small and is determined by the degree of oxidation of the metal.

R. L. Cathcart has resigned from the New Jersey Zinc Co., to become vice president and director of the E. E. Zimmerman Co., Pittsburgh.

Melt High Chromium Alloys In Acid Furnace

By R. S. Kerns

HEAT resisting alloys have been used for some time. The demand grew because the manufacturer specified castings to give better results and longer life in the transmission of high temperature, corrosive liquids and gases, in the parts of annealing furnaces exposed to stresses under high heats, and in fact, any place where the plain carbon steel casting has to be replaced frequently because of its inability to resist high temperatures, that is up to 2200 degrees Fahr., and still be serviceable.

Various alloys have appeared on the market in the past four or five years under trade names, and each one has shown that it is able to withstand the abuse to which it is subjected. The writer does not wish to dwell on the merits of the different heat resisting alloys, and therefore will enumerate some of the uses to which this alloy is adapted.

In the oil refinery, alloy steel has been used successfully in the transmission of hot liquids and gases. The tubes used for this purpose in many cases are subjected to the action of the flames as well as to the action of the liquids. The headers on stills must be able to withstand this punishment and yet retain their shape as well as resist oxidation.

Chromium Important Element

In the annealing furnaces the alloys are used as disks in continuous annealing furnaces as well as in the bottom, sides, and roof. H and I beams of these alloys either cast or rolled, are used where articles are placed in the furnace on racks. Cyanide pots and annealing boxes have shown remarkable life when made from these heat resisting alloys. Disk valves of this material are being used in the gas lines of open-hearths successfully. Where carbon steel has proved ineffective in contact with high heat, these alloys slowly are replacing it. The advantages claimed for the alloys are the ability to resist oxidation and chemical reaction, and possess a minimum deflection when loaded under high heat, such as for beams and supports.

The majority of heat resisting alloys contain a large percentage of chromium, some of them going as high as 30 per cent chromium, others from 15 per cent up. Some of the alloys also contain nickel in varying amounts from 3.50 per cent to 35 per cent. However, one company producing a high chromium heat resisting alloy has found by extensive investigations that the presence of nickel is harmful when the casting is exposed to open flames especially where much sulphur is present in the fuel, the claim being that the sulphur in the flame combines with the nickel forming a nickel sulphide. When the alloy is exposed to sulphur and the nickel sulphide formed, the casting has a tendency to swell or assume a rough warty appearance. Continued contact with the open flame destroys the properties of the nickel bearing heat resisting alloys. In the nickel-sulphur equilibrium diagram we see that a small amount of sulphur will lower the melting point of nickel a hundred degrees or more. However, in the electric annealing furnace nickel does not seem to harm the alloy but instead imparts additional strength to it, only when used in amounts over 3.50 per cent. Below this amount there does not seem to be any appreciable difference in the physical properties of the alloys. This fact was discovered accidently by the writer when melting and producing one of the high chromium heat resisting alloys recently in an acid electric furnace.

Chromium has been used for some time in the production of stainless steels. It has been found that the non-corosive properties are due to the stabilizing of the passive state of the steel by the chromium. However, this is not accomplished unless the chromium is at least 15 per cent. Another theory advanced as to the properties of high chromium steel is that, up to a certain composition, a solid solution behaves toward reagents as does its noblest constituent.

We now have the basis for working up a heat resisting alloy. First, an alloy added to the steel which will impart to the casting or shape the ability to resist the corrosive action of the flames, this has been shown to be chromium in sufficient quantities. Second, the final product must be strong and able to hold its shape under long exposure to high heats, that is from 2000 to 2200 degrees Fahr. With the carbon around 0.40 to 0.60 per cent and the correct percentage of chromium, the product has this second property and will not warp as do plain carbon steel castings. It has been proved that an increase of chromium in carbon steel raises the Ar, and the actinium, points of hypoeutectoid steels. In other words, the temperature range of grain growth has been raised and this imparts to the steel the property sought.

Melting High Chromium Steel

The composition of the particular heat resisting alloy which the writer wishes to discuss is as follows:

Chromium—25 to 30 per cent
Carbon—0.40 to 0.60
Silicon—not over .50
Manganese—0.60 to 0.80
Sulphur—not over 0.05
Phosphorous—not over 0.05

The writer had produced this alloy successfully in a basic lined electric furnace with a rated capacity of 1000 pounds and was called upon several years later to see what results could

Heat Resisting Steel Made on Acid Lining

THE acid electric furnace generally melts faster than the basic, but is handicapped in that reducing conditions cannot be obtained. Certain alloys are oxidized easily and for this reason the melting has been carried out in basic electric furnaces.

In this article R. S. Kerns gives some of the uses of high chromium alloy steel and relates his experience in melting this alloy in the acid electric furnace. Although high losses of chromium were expected, the reverse was true. The procedure in melting is given and some interesting observations noted. Mr. Kerns is now connected with the department of metallurgy, Pennsylvania state college, State College, Pa.

be obtained in an acid lined electric furnace of larger capacity. This furnace was a 3000 pound furnace built by the Pittsburgh Electric Furnace Corp., Pittsburgh.

We expected to lose considerable chromium in the slag, because we were to use an acid lined furnace and because of general working conditions. The representative of the company who was selling the alloy advised the writer to provide for at least an 8 per cent loss of chromium. However, after he had observed the care taken in melting a heat of regular carbon steel he decided to allow for a 4 per cent loss of chromium. The charge was calculated to contain 32 per cent chromium as charged, to yield a 28 per cent chromium product. As a 1 per cent carbon ferrochromium was used it was necessary to use only low carbon scrap. The scrap accordingly was selected from a pile of 0.12 to 0.15 per cent carbon stock and a charge of 3000 pounds made up as follows:

Ferrochromium (1 per cent carbon)	1371 lbs.
0.12-0.15 carbon scrap	1662 lbs.
Total	3033 lbs.

As over one third of the charge was ferrochromium, the problem of charging it was next brought up. The method decided on was to charge some scrap on the bottom of the furnace, then charge some ferrochromium then more scrap and more alloy keeping the alloy in the centre of the furnace so as to protect it from the air as much as possible, and finally the remainder of the scrap. This method had worked satisfactorily in the small furnace but with the larger furnace we ran into difficulties. The scrap melted and allowed the ferrochromium to sink to the bottom of the furnace forming a skull. It took some time before the bottom was finally cleaned off.

Use Chromium Bearing Slag

We were fortunate to receive about 50 pounds of slag from some former heats of this alloy which had been produced in another foundry. This slag was saturated with chromium and the idea was to form a slag at once containing a high percentage of chromium in order to hold more in the slag. In other words it seemed that the slag would absorb a certain percentage of chromium and if a slag could be formed already hold a large percentage of the alloy, the loss in the heat would not be so great. About 30 pounds of the slag was charged in the electric furnace with the scrap and ferrochromium in this heat.

The power was thrown on and all the openings luted up with clay. It was necessary to keep as much oxygen out of the furnace as was posible and attempt to maintain as near a neutral atmosphere as we could. Lime was used freely on the slag but not enough to harm the acid lining. Power was used for about 40 minutes at the rate of 1800 amperes and 135 volts and then reduced to 80 volts and 2400 amperes. After about 90 minutes the door was opened to observe conditions in the furnace and to take a temperature test. It was then discovered that the bottom had a heavy skull and no heat test was taken. Thirty minutes later the bottom again was tried and finally after about 2½ hours from starting the heat the bottom was clean.

Judging the Temperature

It is important that the pouring temperature of this alloy be right, as it must not be poured too cold or too hot Of course, the pouring temperature is determined also by the work to be poured and methods of handling the metal.

Two methods of getting the temperature of the heat in the furnace are as follows: First, by the skin test as used for plain carbon steels, the difference being that one half the time taken for plain steel to skin over is considered a good pouring temperature for the alloy. In other words if it is practice to hold ordinary steel 60 seconds, for a freeze-over then 30 seconds will be long enough for the alloy and will pour with the same fluidity as the 60 second steel. The second method is by observing the fracture of a test piece. When the alloy is cold the fracture resembles somewhat that of tool steel and has an extremely fine grain. As the temperature is increased the grains grow until at a 30 second skim test they are large, perfectly smooth and bright, and arranged in a regular formation following the contour of the test piece. Grains as long as ¼ to ⅜-inch and as wide as 1/16 to ⅛-inch were secured.

One of the problems of the melter is to raise the alloy to a temperature high enough to give the required fluidity and yet cold enough to keep the grains as small as possible. Large grains, which fracture along well defined cleavage planes, affect the ultimate strength of the castings.

Steel Appears Dull

Some of the peculiarities of this alloy are shown in a discussion of this first heat. When we looked in the furnace the heat was lying perfectly quiet. In fact it had a dull, dead appearance, as did the heat test when removed from the furnace. No silicon or killer was necessary, this was due to the large percentage of silicon found in ferrochromium. It analyzed about 1 per cent of this element in the ferroalloy we were using. Twenty-five pounds of ferromanganese was added and after three minutes the writer called for the ladle. A vigorous objection was made by the foundry superintendent who said it was too cold to run out of the furnace. Surprises were in store for him later on. The heat was tapped into a 4000 pound ladle and set on a stand where it was distributed to the molds by means of a 500 pound bull ladle. The heat was poured with a sluggish, dead appearance but showed no tendency to freeze. After several of the castings were poured, one of the molds broke out during the pouring. A shovel of sand was held against the stream but the metal flowed as fast as before, a shovel of wet sand was then tried with no better results. Clay would not freeze the molten metal. The only method the writer has found to stop a break out is to hold a stick of aluminum in the stream. This will freeze the metal, provided the stream is not too large. To all appearances the heat was so dead and sluggish that it seemed impossible to pour die blocks but was so hot it broke through and wet sand or clay would not freeze it. After the heat was poured there was no trace of a skull in the large ladle or in the bull ladle.

The analysis of the alloy showed the chromium content to be 31.6 per cent. Instead of losing at least 4 per cent chromium, the loss was only 0.38 per cent. Accordingly, in the following heats we figured on 30 per cent chromium in the charge to produce 28 per cent in the castings, but the results obtained were so good that we finally were able to base our charges on 29 per cent chromium going in and getting 27 to 28 per cent in the product.

Charging Method Changed

Observations of this first heat showed that a different method of charging the ferrochromium was essential to stop the skull in the furnace. This was done by charging about 30 per cent of the alloy with the whole charge of steel scrap and letting this melt down under as limey a slag as was possible to carry in the acid furnace The remainder of the alloy was added a shovel or two at a time at regular intervals of three or four minutes. This resulted in a shorter

time for the heats, and yet the final analysis was within the limits. When the final shovelful was in, the furnace was sealed up as before. Sufficient time was given to insure that the metal was melted and about hot enough and then heat tests were taken.

Nickel added to the heat, altered the fracture somewhat. The fracture was then fine grained even when the heat was at the correct pouring temperature. It was also possible to bend the test piece, which was 1½ x ¾ x 5 inches long, from 30 to 60 degrees before rupture. The steel containing chromium alone was brittle and this prompted the writer to add nickel. At least 3.50 per cent nickel was necessary to change the structure of the alloy.

When the slag was taken from the furnace and cooled it had a tendency to shrink and present a wrinkled appearance The color was a brownish green looking very much like a piece of leather or a snake skin. The slag which was poured in a cavity in the sand so as to be about three to five inches thick, had a dense structure when broken up. Sometimes the fracture of the slag would be a dark blue and shine. At other times it would have a dull green appearance, and again, we had slags which showed both the blue and the green fracture with a sharp line of demarcation between the two different colors. The laboratory did not have the necessary equipment to run an analysis on these slags so the composition was unknown. However, we did find that the chromium content in the castings were always within the limits set.

Cleaning Room Troubles

As the castings were brittle when they did not contain any nickel, it meant careful handling until they were annealed. The larger castings of from 75 to 200 pounds were provided with fairly large sink heads, and when the cleaning room men attempted to cut the heads off with the oxyacetylene torch, they were surprised to find the flame had no effect on the casting. After changing tips and the flow of oxygen, the heads were cut off with a ragged edge. In the following heats a head was provided with a V-notch where the head joined on the casting. It was then possible to knock the head off with a sledge hammer and not harm the casting

Care was also necessary in snagging the castings, for if the casting was burned by the wheel a hard spot resulted. Therefore, it was necessary to resort to wet grinding. Although the metal was brittle, it matched like gray iron on both thin and thick sections. It was always easy to tell on a machined surface where the snagger had heated the casting as it would show up as a "nigger head" or hard spot. The additions of nickel did not affect the machining qualities of the castings.

Conclusions

After melting several heats we were able to standardize the practice as follows: Charging the ferrochromium; adding about 30 per cent of the alloy with the scrap charge and the remainder in small quantities at short intervals. Judging the pouring temperature by means of the skin test when nickel was used and by the fracture when nickel was not used. Pouring the castings; at no time allowing the stream of metal entering the mold to stop. Grinding the castings carefully to guard against burning which produced hard spots.

It is the writer's opinion that alloy steels can be produced in an acid lined furnace as satisfactorily as in a basic lined furnace when proper care is exercised. Manganese steel is the only exception as this is a basic furnace product.

Embrittlement Avoided In Malleable

(*Concluded from Page* 215)

with the employment of a skip or box charging device. However, with the cut-off curtain which slides up and back, the opening is exposed fully and its use made possible the batch charge, as the box of castings could be hoisted and dumped directly into the barrel.

The next step in the procedure after cleaning is to file or grind off sprue or grate marks, pins, etc. The castings are straightened and any necessary holes bored to the proper size before the castings are sent to the inspection department. In this department shown in Fig. 7, all castings are subjected to close scrutiny for any defects. After passing the inspection, the castings are ready for shipment or for the galvanizing kettles.

Hot-dip galvanizing is one of the oldest methods of rust prevention, and is the process in use at the Ohio Brass Co. A view of one of the four galvanizing kettles is shown in Fig. 1. The zinc bath is maintained at a temperature from 850 to 860 degrees Fahr. Sal ammoniac is used for a flux cover and the kettles are hooded to carry off any fumes. The preparation of the castings for hot-dip galvanizing is similar to that described for sherardizing. After the castings are cleaned and inspected they are given an acid pickle to make sure that the surface is perfectly clean. The castings are dipped in hot water to remove the acid and assist in drying the castings quickly. After drying, the castings are ready for galvanizing. Each casting is hand dipped in the galvanizing kettle, allowed to drain slightly and then quenched in hot water. The average time of dipping is 1½ minutes. This has been found to give the required thickness of zinc coating.

This heat treating process has been in use at the Ohio Brass Co., for the past two years. All malleable castings made by this firm have undergone this treatment whether they were to be galvanized or not. During this period over 8000 tons of castings have been treated with but slight loss due to embrittlement. The process is claimed to assist in machining because a more uniform product is assured. Also it has been found that if the iron is embrittled by galvanizing or otherwise, this heat treatment will remove the condition and they can be regalvanized without embrittlement. The process has been tried on malleable cast iron of varying analyses with phosphorus as high as 0.35 per cent and silicon as high as 1.60 per cent, and it is said that no embrittling effect occurred.

Reagents for Etching Alloy Steels

Etching with acidic solutions offers no means of distinguishing between iron, chromium, tungsten, and vanadium carbides, iron tungstide and the complex constituent usually found in high speed steels. Alkaline solutions exert two distinct reactions, one being a chemical attack on the constituent, and the other being an oxidation of the constituent by nascent oxygen generated by the reaction between the reagent and certain salts in the solution. Electrolytic etching tests, using solutions of weakly dissociated acids and both alkaline and metallic salts of these acids, produced an etching effect that could be directed to the constituent while the iron matrix remained unattacked.

The principles governing these actions with explanatory diagrams of iron carbon systems and micrographs are given in the bureau of standards, scientific paper No. 518. This paper may be obtained from the superintendent of documents, government printing office, Washington, for 25 cents.

Bill Describes a Hydraulic Ram Pattern

By Pat Dwyer

LAST Wednesday as the guest of a member I attended the weekly noon day lunch of a club made up of alumni of a group of mid-western universities. The speakers on these occasions are men more or less in the public eye through some form of activity and in that way the topics discussed during the year cover an almost infinite range.

Usually the speaker presents his views for about half an hour on some subject or a phase of some subject with which he is particularly familiar. On this occasion the speaker introduced an innovation. He spoke for ten minutes on the subject of general knowledge and claimed that the average man knows comparatively little. He admitted that in specialized lines many men are exceedingly proficient but outside their specialty these same men in many instances are no wiser than children.

He went farther and stated that even university men are not omniscient. To prove his point he had cards containing 25 questions distributed among the audience and intimated that probably not one man present could answer all the questions correctly, or even approximately in some cases. Beginning with the first he gave a running comment on each question and allowed a few seconds for setting down the answers. Then he passed to the next question on the list. At the conclusion of the quiz he supplied the correct answers and the members checked their answers right or wrong accordingly. The result was surprising. I found that I was fairly dumb, but I was consoled somewhat by the fact that I at least was numbered with the majority. In my contribution that same evening to the merry chatter which enlivens the evening repast in our modest cot I mentioned the noon time experience. I said I was ashamed to admit that my pride had received a severe jolt. Commencing that selfsame night I proposed to dust off the old encyclopedia and do a little intensive reading every night until I had gone the whole round from *A* to *Dram*, to *Sarg* to *Z*.

The lady who sits at the opposite end of the table said that I did not need to go to a luncheon downtown to learn how little I knew and if I thought I was going to sit back every night like an owl in an ivy tree wasting my time browsing through a bunch of musty old tomes, I had another and a healthy sized guess coming to me. Of course, you understand I am not quoting her literally. I merely present the general sense of the argument. What you might call a free translation.

"Breakers ahead!" Says I to myself. "All hands stand by to wear ship!" I threw the wheel hard over to escape the conversational rocks and started to beat out to sea by remarking casually that I had seen an item in the morning paper to the effect that one of our well known movie heroines had just signed a new contract calling for an additional million dollars a year.

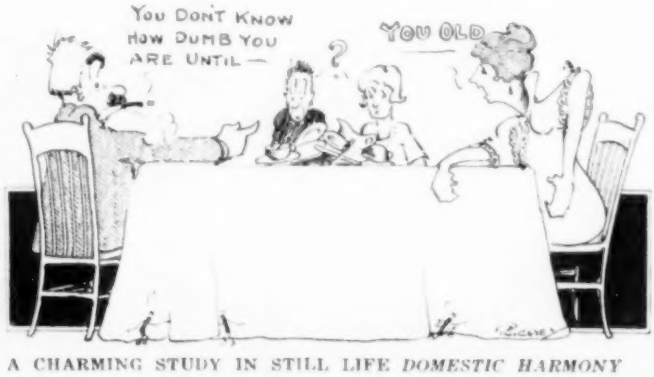
Usually this is a sure fire lead. The lady is a keen devotee of the silent drama and apparently believes every statement issued by the enterprising press agents connected with the industry. This is all the more remarkable in view of the fact that she is perfectly sane on every other subject and in fact is more or less skeptical in regard to other statements that appear daily in our great source of unbiased news the free and untrammeled press.

My well meant effort was a failure. I am not prepared to go on record as stating that the lady is the most curious person that ever lived, but I will say she was not behind the door when that popular feminine attribute was distributed among the daughters of men. She asked me to repeat the list of wonderful questions that had exercised such a chastening effect on my spirit.

I admitted I could not remember the entire list, but I would present three and if she could answer them, why, she was a better man than I was Gunga Din. She informed me icily that I might omit reference and comparison to dissolute and abandoned members of my friends and acquaintances. People who wore nothing much before and rather less than half of that behind were hardly fit characters to be introduced in a conversation where children were present.

"Well" I said "Here are the questions. Let's see what you can make of them. 1—Which city in Europe has the largest Czecho-slovakian population. 2—What is ex-president's Taft's salary as chief justice of the supreme court. 3—How many stories in the Woolworth building?"

"What a perfectly silly set of questions" said she. "There are more Czecho-slovaks on St. Clair avenue, Cleveland, than there are in Constantinople or Spitz Bergen or wherever it is the few remaining members still are waiting for passage money to bring them out here. I am not married to Dr. Taft, therefore his salary is a matter of supreme indifference to me. As for the Woolworth building, what do I care whether it has 40 stories or 400. It takes me all my time checking up the stories you bring home including this latest,



A CHARMING STUDY IN STILL LIFE *DOMESTIC HARMONY*

one about a band of presumably sensible men wasting an hour trying to answer a set of questions of no earthly use when they might be more profitably employed in earning an honest dollar to chase the wolf away from the door."

Later in the evening Bill came in and I brought the subject up again. He cannily sidestepped the main issue and refused to commit himself either on the wisdom or utility of the questions. The subject appealed to him along a certain line that had not occured to me. "Taking them by and large," said Bill, "these university lads are fairly well posted considering the conditions under which they acquire an education. In recent years probably university life has changed considerably but I am thinking now of the middle aged boys who passed through the classic halls of learning 20 or 30 years ago. We had a metallurgist with us one time who came out of McGill in '98. According to his account the brave old boys of those days devoted more time to sampling beer and other invigorating beverages than they did to analyzing metals and other prosaic inorganic materials. All their funds were devoted diligently to scientific investigation along their favorite line and as a consequence finances frequently were at a low ebb.

"One of this lad's stories was based on a distressing episode of this kind. After a particularly strenuous night devoted to determining the ultimate holding capacity of the human body he awoke near noon as parched as Pharaoh's mummy. He found himself in his room in company with four or five boon companions who had assisted at the experiment on the preceding evening and all in a similarly pitiable condition. A slow and careful check of the combined financial resources disclosed to their pained surprise that if the elixer of life was quoted at one kopeck per puncheon they could not purchase a one-tenth of one per cent interest in the froth on top of a stein.

"However, as the lad was wont to remark at this point, Providence was on the job as usual tempering the wind to the shorn lamb. Cute bunch of lambs if you ask me. Just at the moment when life might be compared to a shovel full of Dead sea ashes, a hurdy-gurdy man's monkey hopped over the window sill into the room. The same brilliant inspiration struck two of the lads at the same moment. One closed the window and the other grabbed the monkey. He turned the little financier upside down and shook all the accumulated wealth out of his pockets. Then the first conspirator opened the window. The second released the chattering and terrified little hero in the red coat who dived through the window like grease through a tin horn, while the gang

Illustrating Financial Term: Shaking Him Down

eagerly collected the manna in the desert. Only young men of undoubted stamina and great natural force of character could successfully pursue a four year course under obstacles of that kind.

"Foundrymen sometimes are confronted with perplexing problems. I had a letter the other day from a man who had an order for a big hydraulic ram and whose shop equipment was inadequate for handling a job of that kind in a proper manner. He had a flask and two 7-inch core barrels 13 feet long but he had no pattern and on account of limited head room he had to cast the ram in a horizontal position. The casting was a little over 24 feet in length, 21 inches diameter outside, 15 inches diameter inside except at the two ends where the openings were restricted to 9 inches. That is no job for an amateur and I doubted if written instructions would be sufficient, but under the circumstances I had no alternative and I wrote him as follows:

Without any pattern the simplest way to make the ram is to first sweep the core and dry it. Then add two more thicknesses of hay rope and a sufficient thickness of loam to form the desired outside size of the casting. This is dried and used for a pattern. After the mold is made, the thickness is removed and the core is returned to the mold. Of course this is just a bare outline and is presented on the assumption that you are familiar with loam molding methods.

In the event that you are not familiar with these methods the following details may be of assistance. In addition to the core barrels you will require two round, cast-iron plates, ½-inch thick and 13 inches in diameter with a 7¼-inch hole in the center of each. These cast iron disks are provided with short dabbers all over one side or are otherwise roughened to hold the loam. They are wedged on the ends of the barrels that touch in the center of the casting. Two wood disks 21 inches in diameter and provided with 9¼-inch holes in the center are made to fit on the core print near the outer end. These discs form a neat outer end for the pattern and also help to retain the rope and the loam. It is advisable to build these ends from narrow boards about ¼-inch apart and held together by a few battens on the inside. This form of construction will prevent the ends from warping unduly while in contact with the wet loam. Approximately 4000 feet of 1-inch hay rope will be required to place three strands around the barrel for the core and two strands around the core to form the pattern. Since the two sections of the core are made in a similar manner a description of the method employed to make one will be sufficient. The 13-inch cast iron disc is fastened about 1 inch from the end of the core barrel. Thin wood wedges are used to hold it in place. Wood is used in preference to wrought iron or steel to facilitate the removal of the arbor from the casting. The arbor then is mounted on two supports where it is revolved by a suitable crank handle inserted in one end.

Under ordinary conditions at least 3 or 4 inches would be allowed at each end of the arbor for clearance where the ends rested on the supports. In the present case only 1 inch is allowed for a bearing on the inner end of the arbor, because eventually that end has to be built up with loam or core sand. The distance of 1 inch is not given as an arbitrary distance. It may be increased to 1½ or 2 inches, but with care the distance can be held to a minimum of 1 inch.

After the arbor is set and the bearings oiled the arbor is brushed with either water or claywash and the first strand of hay rope is wound around the barrel from the disk at one end to within a few inches of the opposite end. This limit is decided by the position of the horse supporting the end of the arbor. The object in wetting the barrel is to give the hay rope a grip and prevent it from slipping. A thin coating of coarse loam is rubbed over the rope and a second strand of rope is wound on the barrel from the disk to the point

on the outside end where the shoulder commences. A single strand of rope is all that can be placed on that part of the barrel that passes through the end of the casting and forms a core print on the outside. A third course of rope applied in the same manner will bring the diameter up to 13 inches or within an inch all around of the finished size.

A coating of coarse loam is applied to the revolving barrel and is struck to approximately the right diameter by a long straightedge or sweep mounted horizontally on suitable supports at one side of the core. The sweep of course is cut at one end to conform to the shape of the shoulder and print extension. The coarse loam is allowed to stand until it becomes hard and dry and then is covered with a coating of thin or finishing loam which brings the core to the exact size required and also forms a smooth surface. Usually a satin coat is not required on a core of this kind, but in the event that the coremaker is fastidious he may impart such a coat by applying a thin coating of *slurry* made from sand that has been passed through a No. 8 sieve and then mixed with water to the consistency of cream. By placing a short piece of 5 or 6-inch pipe in the short end of the core a pair of crane chains may be hooked directly to the arbor to lift the core from the horses to the core carriage. The second half of the core as previously stated is made in a similar manner on the same supports.

After the cores are dried they are taken from the oven and once more placed on the stands where they are treated to two thicknesses of hay rope and a coat of loam which is struck off to a diameter of 21 inches, the size of the required casting. The wood disks are slipped into place at the print end of the core and wedged in place truly at right angles with a center line of the core. These disks are left in place while ramming the drag and cope of the mold, therefore the overall measurement for the pattern must be taken from the outside of one to the outside of the other. It is scarcely necessary to add that all measurements must be taken with a shrink rule. If an ordinary rule is used allowance must be made for the contraction of the casting which will amount to nearly ¼-inch in the outside diameter and to a little over 3 inches in the total length.

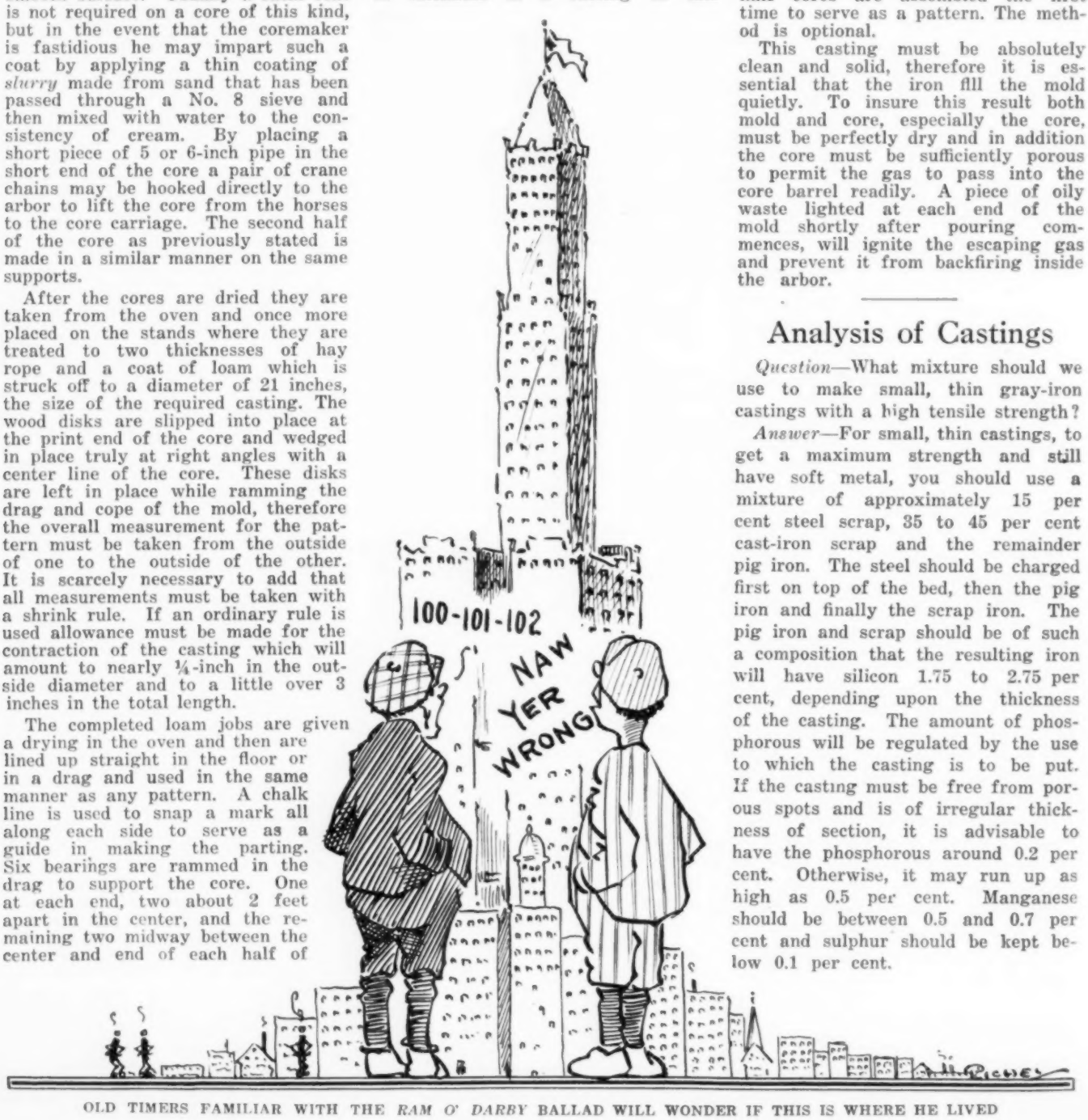
The completed loam jobs are given a drying in the oven and then are lined up straight in the floor or in a drag and used in the same manner as any pattern. A chalk line is used to snap a mark all along each side to serve as a guide in making the parting. Six bearings are rammed in the drag to support the core. One at each end, two about 2 feet apart in the center, and the remaining two midway between the center and end of each half of the core. With a good, stiff cast iron core barrel the center support may be omitted.

Three chaplets will be required on the upper side of each half of the core. This, in addition to the iron bar or the stanchion used over the print. An iron stud is placed on the core barrel at each point designated to come in contact with the chaplets in the core. These points are marked on the barrel and the studs adjusted before the rope is wound in place. Two chaplets are placed on each side near the center. Considerable pressure is exerted against the lower side and unless the core is held firmly in place it will rise in the center with a consequent variation in the thickness of metal in the upper and lower sides of the casting. From a purely utilitarian viewpoint a little variation in thickness does not matter, but unfortunately a variation in thickness in a casting of this kind causes the casting to warp out of a "straight line" and prevents it from cleaning up in the lathe.

The casting will weigh between 6 and 7 long tons, depending upon how close the pattern and core have been held to size, and may be poured either from one end or from both ends. A fair sized riser is placed over each end for a feeder and three other feeders are provided on top at equidistant points.

The mold is taken apart and finished, blacked and dried in the usual manner. The thickness is removed from the cores and the cores themselves are returned to the oven for a final and supplementary drying. At this stage also the inner ends of the arbors are plugged and the ends of the cores are made up straight and at right angles to the main body of the core. This part of the job also may be done when the two half cores are assembled the first time to serve as a pattern. The method is optional.

This casting must be absolutely clean and solid, therefore it is essential that the iron fill the mold quietly. To insure this result both mold and core, especially the core, must be perfectly dry and in addition the core must be sufficiently porous to permit the gas to pass into the core barrel readily. A piece of oily waste lighted at each end of the mold shortly after pouring commences, will ignite the escaping gas and prevent it from backfiring inside the arbor.



OLD TIMERS FAMILIAR WITH THE *RAM O' DARBY* BALLAD WILL WONDER IF THIS IS WHERE HE LIVED

Analysis of Castings

Question—What mixture should we use to make small, thin gray-iron castings with a high tensile strength?

Answer—For small, thin castings, to get a maximum strength and still have soft metal, you should use a mixture of approximately 15 per cent steel scrap, 35 to 45 per cent cast-iron scrap and the remainder pig iron. The steel should be charged first on top of the bed, then the pig iron and finally the scrap iron. The pig iron and scrap should be of such a composition that the resulting iron will have silicon 1.75 to 2.75 per cent, depending upon the thickness of the casting. The amount of phosphorous will be regulated by the use to which the casting is to be put. If the casting must be free from porous spots and is of irregular thickness of section, it is advisable to have the phosphorous around 0.2 per cent. Otherwise, it may run up as high as 0.5 per cent. Manganese should be between 0.5 and 0.7 per cent and sulphur should be kept below 0.1 per cent.

How and Why in Brass Founding

By Charles Vickers

Gives Mixture for Name Plate Castings

We have a number of name plates to make with letters which are small and fine, some of them like hair lines. We would like to get a formula for a mixture of brass or bronze that will run sharply and withstand the weather. We also are making castings of aluminum in the shape of a table top, 3 feet wide and 8 feet long with which we have a little trouble at times from scars and pit holes which show after the castings are roughed off. We will greatly appreciate any suggestions that will enable us to avoid such losses. The material we have to use is scrap, such as kettles, dishes and such ware, which we mix in equal parts with scrap crank cases.

The cheapest mixture for name plates is one suggested by Erwin S. Sperry a number of years ago which consists of copper 50 per cent, zinc 50 per cent, to which is added 2 ounces of aluminum. It is a yellow brass that will flow easily. It cannot be made from scrap metal unless, it is a yellow brass scrap, the analysis of which is accurately known. When yellow scrap of unknown composition has to be used, little zinc may be added without danger of getting a brittle alloy.

A red metal that flows easily is copper 86 per cent; tin 3 per cent; zinc 9 per cent; lead 2 per cent. Scrap copper may be used in making the alloy.

An aluminum alloy casting of the dimensions given is a difficult casting to make even when virgin metals are used; with scrap of the cheapest kind the troubles are accentuated. The grade of molding sand is important, for if it is close in nature, the aluminum will not lie quietly in the mold. This agitation will produce bubbles in the casting. The sand must be open; the mold should be faced and skin dried thoroughly. If the brass sand in use is not open enough, which may be determined by casting a small mold in open sand, add some sharp sand to it. If the metal lies quietly in the mold, sprues, gates and risers, the casting will come good, provided it is not poured too hot. This mistake causes the fine pinholes. However, these will not show if the metal is no hotter than a dark red in the shade, and this temperature should flow the casting completely. Much will depend on the thickness of the plate; a thin plate may require casting by the use of drop pencil gates distributed over the surface. A thick casting may be poured from the sides or the ends. If the casting is thick enough to be poured entirely from one end; this will give good results, but the mold must be inclined with the pouring end lowest so the metal will have to flow uphill. There must be heavy risers on the other end and probably along the sides. No matter how the casting has to be gated, the sprues and risers should be at least twice as high as in the case of a mold to receive brass instead of aluminum alloy.

Hardening Cast Copper

I would like to know if there is any call or need for hardened cast copper. I make such castings from 50 to 100 per cent harder than copper as commonly found in castings. Not only is this cast copper so much harder but it machines like iron in that it does not clog the tools. I am using a flux which puts glass into the copper.

There seems to be a certain demand in some quarters for a hardened copper, and this is supplied usually by casting the shapes of ordinary annealed copper, then forging them. This brings up the hardness to 90 and 100 brinell. The castings have to be oversize when made and only simple shapes may be so made. A hard cast copper of high conductivity to electricity would undoubtedly find a market, and it would be advisable to take the matter up with makers of electrical equipment who use cast copper in their machines.

However, before going to any great expense, it would be well to forward samples of the copper to the bureau of standards, Washington, and have brinell hardness measurements made and also tests for electrical conductivity, because in the absence of such tests it is easy to imagine qualities that do not exist. Cast metals and alloys are deceiving to the nontechnical man. We confess our ignorance of what effect glass would have if *alloyed* with copper, neither have we any idea of how to make such admixtures.

Make Alloys for Pumps from Lead Base

We have been trying to discover an alloy that will stand at least 350 degrees Fahr. not shrink, is fairly strong and will withstand hydrochloric and other acids. After testing nearly every composition that came to mind we found that chemically pure lead with about 1.5 per cent copper was about the best. We also found that pure lead alloyed with 1.5 per cent copper and some 4 to 5 per cent antimony gave good results.

We want the lead hard as it must be cast into pump castings which weigh 150 pounds and more. In some cases it is found the lead at the top will sluff of and run down because of the temperature to which it is exposed.

Several years ago the late Erwin S. Sperry made come experiments to determine the amount of copper that would be dissolved by pure lead, with the result he found that it would absorb some 2.5 per cent copper. However, when other metals are present, the copper is higher, depending probably on the amount of the other elements present.

There should be no difficulty in alloying 1.5 per cent copper with lead. It would be advisable to make the alloy by use of a hardener and one consisting of antimony and copper in any suitable proportions such as 25 per cent copper; 75 per cent antimony would be suitable. If the antimony was melted first and the copper added in thin sheet form the latter metal would dissolve. Admixtures of 50 per cent lead and 50 per cent copper are made frequently by the use of such fluxes as plaster of paris and soda ash, and such a hardener would be convenient as a means of alloying the copper.

The cause of the sluffing away of the lead in service may be due to a higher temperature than the alloy will withstand, for lead melts at a comparatively low temperature. The addition of a higher melting point metal would correct this difficulty. As a hard alloy is desired probably what is known as Regulus metal would be suitable. This alloy consists of lead 87 per cent; antimony 11 per cent; copper 1 per cent; tin 1 per cent and it is used for acid containing vessels and for pump work.

Book Review

Refining Metals Electrically, by Larry J. Barton, 414 pages, cloth 6 x 9 inches, published by the Penton Publishing Co., Cleveland and supplied by THE FOUNDRY, Cleveland, for $6.00, postpaid.

Twenty years ago, the first electric furnace devoted to melting metal for steel castings was installed in the United States. Since that time the industry has expanded until at present there are nearly 500 electric furnaces in use for melting iron and steel for all purposes.

Electric furnace metallurgy while similar in many respects to that which governs the other processes of iron and steel production, is a distinct field as those who have had experience will agree. Much has been published in the technical and scientific press relating to the electric furnace, but up to the present no book deals with electric furnace practice as encountered exclusively in the foundry. Mr. Barton, in his interesting volume describes the theory and stresses the practical operating side of electric iron and steel melting. The inexperienced melter or beginner in electric furnace operation can read this work and gain an understanding of how the various details are carried out. A perusal of its pages will not, like the consultation of the wishing ring, make a man a melter; but a careful study of the subject matter by anyone whether he be a neophyte, operator, manager or executive of an electrically-equipped foundry, will result in giving the reader an insight into the complex workings of the furnace.

The subject matter is well arranged and covers such points as costs of melting, power contracts and factors deciding the type and size of furnace to operate. Maintenance, renewal items, types of linings and practical control features which assure economical operation with satisfactory metallurgical results are discussed thoroughly. The melting of steel in the acid and basic furnace is described in detail with chapters on the alloy steels such as manganese, nickel, chromiun, molybdenum, silicon, etc.

Important features of the book are the chapters on gray and white irons and the use of alloys. The appendix contains logs of various heats run by the author with comment on the operations performed from time to time. These will assist other operators in comparing their heats with previous practice in the experience of the author.

A selected bibliography that contains a wide and varied list of books and papers dealing with the electric furnace completes Refining Metals Electrically, and adds to its utility.

Use of Electric Heat in Modern Industry

Present day practice in modern industry is to improve the quality of its products while utilizing the most economical methods. Processes that require a source of heat find that both of these objects are promoted by the application of electricity. To show the increasing application of electric heating devices in the various industries, the General Electric Co., Schenectady, N. Y., has issued a publication containing illustrations of working installations.

The heating devices range from the small cartridge type used on a shoe-sewing machine to the large units employed in core ovens and furnaces for heat treating large castings.

Electric heat is used in the metal, ceramic, enameling, chemical and printing industries. It is used to bake bread, make doughnuts and cook macaroni. Electrically heated glue pots are found in woodworking and paper box factories.

Faked Foundry Facts

A High Blast

D. J. Martin formerly with the Tabor Mfg. Co., Philadelphia, now is connected with MacDonald Bros., Inc., Philadelphia.

Issue Proceedings

The American Society for Testing Materials has published recently volume 25 (1925) of its annual Proceedings. The volume is in two parts and is summarized as follows: Part I (962 pp.) contains the annual reports of 35 of the standing committees of the society, together with the discussion thereon at the annual meeting. They include reports of committees on ferrous metals, non-ferrous metals, cement, ceramics concrete, gypsum, lime, preservative coatings, petroleum products, road materials, coal and coke, waterproofing materials, electrical insulating materials, rubber products, textile materials, thermometers, metallography, including a report on metal radiography and x-ray crystallograph, methods of testing and nomenclature and definitions; 83 tentative standards which have either been revised or are published for the first time; annual address of the president and the annual report of the executive committee. Part II (454 pp.) contains 26 technical papers with discussion. These contain valuable information on results of investigations by experts in the field of engineering materials including the fatigue of metals, the effect of temperature on the properties of metals and investigations on the corrosion of metals. Mention should also be made of the many papers on cement and concrete and on the stability of bituminous mixtures as well as on such subjects as bituminous materials, paint, gypsum, brick, textiles, etc.

Each part is available at the following prices: $6.00 in paper, $6.50 in cloth and $8.00 in half-leather binding. Copies may be obtained from C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia.

Secure Contract for Airplane Motors

The Packard Motor Car Co., Detroit, has been awarded a contract for 150 airplane engines, according to an announcement of Secretary Wilbur of the navy department. This is the largest single aviation contract made by the government since the end of the war and the total amount involved is $2,364,000. Orders placed call for 116 planes of various types and 261 engines. Additional planes probably will be ordered in the near future.

Plan Pipe Standardization

Sectional Committee on Standard Specifications for Cast Iron Pipe Being Formed To Revise Specifications

A STANDARDIZATION project of far-reaching importance is about to be inaugurated through the formation of a representative committee on cast iron pipe, which will undertake a general program of unifying existing specifications for cast iron pipe into a consistent set of nationally recognized specifications. This committee, which will be officially known as the sectional committee on standard specification for cast iron pipe is being sponsored by the American Gas association, American Society for Testing Materials, American Water Works association and New England Water Works association and will function under the procedure of the American engineering standards committee.

This development is the outcome of the submission two years ago by the American Gas association of its standard specifications for cast iron pipe and special castings to the American engineering standards committee for their approval as American standard specifications. It became evident that consideration of these specifications for such approval would involve the standardization of cast iron pipe in general, and at a conference held under the auspices of the American engineering standards committee, which was widely represented by industries producing and using this product, it became clear that whereas dimensional standardization was involved principally in the specifications for gas pipe, a broader treatment of the whole problem was essential if results of the greatest benefit were to be obtained. At this conference the need for a study of the quality of metal in cast iron pipe and the problem of suitable coatings were emphasized as of primary importance to waterworks engineers.

Recently developed methods of producing cast iron pipe must be taken into consideration. The American Gas association was willing to have the project broadened, and upon the recommendation of the conference the American engineering standards committee agreed to set up a broad program of standardization of cast iron pipe under its auspices and invited the American Gas association, American Society for Testing Materials, American Water Works association and New England Water Works association to sponsor the organization of a representative sectional committee to carry on the actual work of investigation and standardization.

The scope of the work has been defined as follows:

Unification of specifications for cast iron pipe, including materials; dimensions; pressure ratings; methods of manufacture (including such new developments as centrifugal casting), in-so-far as they may be necessary to secure satisfactory specifications; elimination of unnecessary sizes and varieties; consideration of the possibility of developing a co-ordinated scheme of metallic pipe and fittings applicable to all common mediums; and methods of making up joints in-so-far as they are determining as to the dimensional design of cast iron pipe.

The types of cast iron pipe to include: bell and spigot pipe; flanged pipe; flanged and bell mouth fittings and wall castings; pipe elbows, tees, Y's, return bends, and other fittings not now included in standard lists; cast iron pipe threaded for flanges or couplings; soil pipe and other light types of cast iron pipe and fittings. The standardization is not to include methods of installing pipe and similar matters, except as to the making up of joints in its relationship to the dimensional standardization of pipe and fittings, as noted above.

The sponsors have been engaged in the details of organizing the sectional committee, which will comprise representative producers and users of cast iron pipe, and independent technical experts.

Eleven technical societies and associations now are represented in the work of the committee. This stage of the work is practically completed and the sponsors have an-

Personnel of Sectional Committee on Specifications

American Gas Association

Walton Forstall, Engineer of Distribution, United Gas Improvement Co., Philadelphia.

H. E. Bates, Assistant Chemical Engineer, Peoples Gas, Light & Coke Co., Chicago.

C. C. Simpson, Jr., General Superintendent, Department Mains and Services, Consolidated Gas Co., New York.

American Railway Engineering Association

C. R. Knowles, Superintendent, Water Service, Illinois Central Railroad, Chicago.

C. P. Van Gundy, Water Engineer, Baltimore & Ohio Railroad, Baltimore.

American Society of Civil Engineers

F. H. Stephenson, Assistant Superintendent, Detroit Department of Water Supplies, Detroit.

American Society of Mechanical Engineers

J. E. Gibson, Manager and Engineer, Commissioners of Public Works, Charleston, S. C.

American Water Works Association

Thomas H. Wiggin, Consulting Engineer, 415 Lexington avenue, New York.

William H. Brush, Deputy Chief Engineer, Department Water Supply, Gas and Electricity, Municipal building, New York.

W. C. Hawley, Chief Engineer and General Superintendent, Pennsylvania Water Co., Wilkinsburg, Pa.

E. E. Wall, Water Commissioner, 312 City hall, St. Louis.

F. A. Barbour, Hydraulic and Sanitary Engineer, Tremont building, Boston.

National Fire Protection Association

C. W. Mowry, Director, Factory Mutual Laboratories, Boston.

U. S. Bureau of Standards

I. J. Fairchild, Bureau of Standards, Washington.

Underwriters' Laboratories

A. W. Claussen, Assistant Engineer, Underwriters' Laboratories, Chicago.

J. B. Clow & Sons

Kent S. Clow, Vice President, Chicago.

American Society for Testing Materials

Richard Moldenke, Consulting Metallurgist, Watchung, N. J.

S. R. Church, Technical Adviser, The Barrett Co., New York.

New England Water Works Association

F. A. McInnes, Consulting Engineer, Boston.

C. W. Sherman, Consulting Engineer, Boston.

W. R. Conard, Burlington, N. J.

Manufacturers Standardization Society of the Valve and Fittings Industry

C. R. Wood, 400 Chestnut street, Philadelphia.

American Cast Iron Pipe Co.

W. D. Moore, President, Birmingham, Alabama.

Glamorgan Pipe & Foundry Co.

A. M. Campbell, Lynchburg, Va.

Lynchburg Foundry Co.

W. G. Hammerstrom, Lynchburg, Va.

National Cast Iron Pipe Co.

A. M. Ford, Assistant Engineer, Birmingham, Ala.

R. D. Wood & Co.

Walter Wood, 400 Chestnut street, Philadelphia.

Warren Foundry & Machine Co.

Shellman B. Brown, Superintendent, Phillipsburg, N. J.

U. S. Cast Iron Pipe & Foundry Co.

N. F. S. Russell, President, Burlington, N. J.

D. P. Hopkins, Vice President, Burlington, N. J.

D. B. Stokes, General Sales Manager, Burlington, N. J.

nounced the personnel of the committee as shown in the accompanying box.

The formation of this committee brings together for the first time the major technical societies interested in the various phases of the cast iron pipe problem. It is anticipated that the co-operation of the producers and consumers upon the broad basis thus made possible will result in the development of national standards of quality and dimensions acceptable to all.

Plans for the formal organization of the committee in the near future are being made and will be announced shortly.

Pattern Design Influences Production

By B. Rupert Hall

PROPER construction and design of a pattern is a matter of vital importance to any manufacturing plant. An error in determining the method of producing the mold, this point depending on the manner in which the pattern has been designed, inevitably will cause a serious financial loss. It is fully as serious an error and as costly to the manufacturer to design a part for which the pattern and casting easily may be made, but which is difficult and expensive to machine later.

Necessary processes required in the production of a casting are distinct in themselves and include designing, drafting, patternmaking, founding and machining. A few words of criticism from a competent advisor familiar with all these processes while the design is taking form, might result in alterations and effect a great saving both in molding and in machining cost.

The proper place to determine the design and the method of making the pattern, which determine the molding method, is in the engineering drafting room. If the co-operation between the engineer and the patternmaker were close enough, most serious errors would be avoided in this regard and a great deal of the trouble at present encountered in the foundry and in the machine shop would be prevented.

The pattern for the gas manifold shown in the accompanying illustration is a case in point. The three coreboxes used to form the cores required in the first design are shown in Figs. 1 and 2. A right and a left corebox were provided for the large core. The box for the small core was made with interchangeable parts. Both halves of the core were made in one box. The corebox used in connection with the second design Fig. 3 requires no loose pieces.

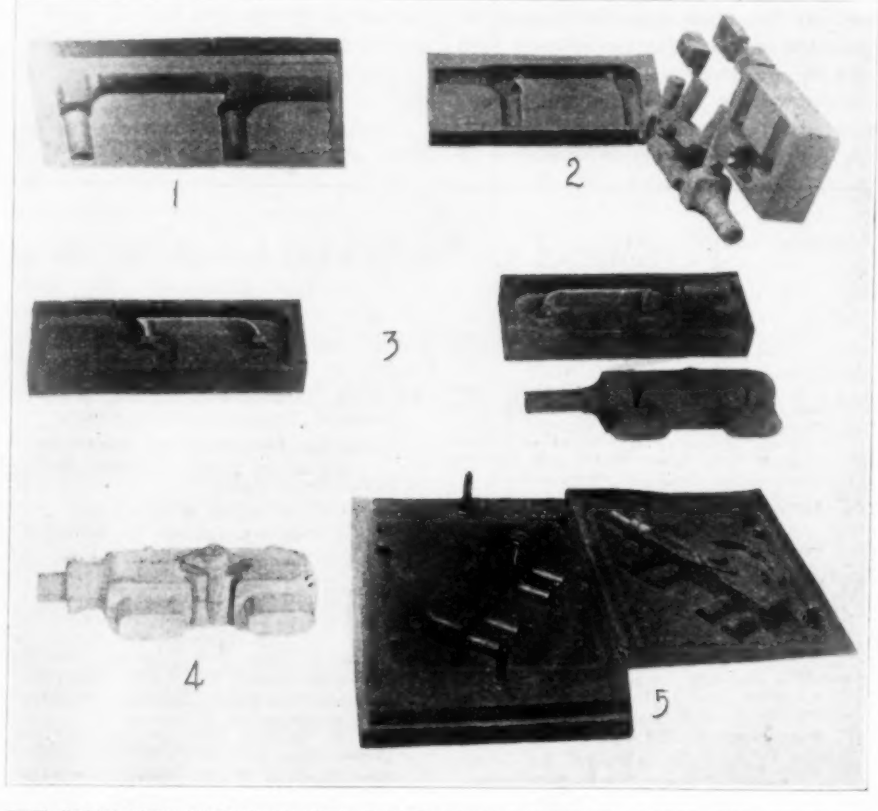
A comparison of these two methods of making coreboxes will illustrate how materially correct design will affect the time and effort required in the production of castings. The first pattern made for the manifold is shown in Fig. 5. The pattern design shown in Fig. 4 and the corebox shown in Fig. 3 show evidence of planning the work before attempting to execute it.

In the first method the two cores are made separately. In the second design the two cores are united and made in one box, made up of a right and left half. One of the advantages of this is the complete core may be made and set in the mold in the time formerly required to make and set each of the two single cores. The work may be further improved in the molding operation. To facilitate production the improved pattern may be mounted on a plate for machine molding as the first pattern is shown mounted on a plate in Fig. 5.

The Interstate Foundry Specialties Corp., has moved its New York office from 248 Fulton street to 461 Fourth street. The company is controlled by S. H. Cleland and E. Kahl and is a representative of the New York & Pennsylvania Clay Products Co., the H. E. Mills Mfg. Co., and the Plum Point Molding Sand Co.

Form Publishing Firm

A company has been formed in London to combine the interests of a number of business publications which includes the *Foundry Trade Journal*, *Ryland's Directory*, and *Iron and Coal Trades Review*. The company is known as *Industrial Newspapers, Ltd.* with Sir Arthur Lowes Dickinson as chairman. In addition to the publications mentioned above the company will own, *Coal Merchant and Shipper*, *Advertising World*, *Textile Mercury*, *Tobacco*, together with the goodwill of *The Tobacco Trade Exhibition*.



THE COREBOXES SHOWN IN FIGS. 1 AND 2 WERE USED IN CONNECTION WITH THE FIRST PATTERN FIG. 5. LATER THE PATTERN WAS CHANGED AS SHOWN IN FIG. 4. COREBOX AND CORE FOR THE IMPROVED DESIGN ARE SHOWN IN FIG. 3

Consider Weights on Blueprints

Washington Meeting Requests Representative Committee Be Appointed To Investigate and Report at Detroit Meeting of A. F. A.

By Fred B. Pletcher
Washington Correspondent, THE FOUNDRY

REPRESENTATIVES of foundry interests and foundry trade associations, at a meeting with users of foundry castings, and others, in Washington on Thursday, Feb. 25, took steps to promote a broad program for the elimination of avoidable industrial waste in the foundry industry.

The meeting was called at the request of several foundry trade associations, producers and users of castings, to consider adopting the practice of showing weights of castings on blueprints sent to foundries for estimate, and was held with the national committee on utilization of metals, of which W. Chattin Wetherill, director of metals utilization of the department of commerce, is the head.

Because of a number of conflicting angles and some complications presented at the conference, it was decided that the department of commerce be authorized to appoint a committee representing malleable, gray iron, steel and brass foundry interests and their associations, and to include the producers, distributors and users of foundry products, this committee will consider the elimination of waste with emphasis on the "wasteful procedure of submitting blueprints to foundries without first indicating the weights of castings." The committee is to make a survey of the questions at issue and to report at a general meeting of all interested to be held coincident with the American Foundrymen's association meeting in Detroit the latter part of September.

William H. Barr, president, National Founders association, Fred G. Wolf, American Car & Foundry Co. and Robert E. Belt, secretary, American Malleable Castings association, comprise a committee to work with the department in naming a general committee representing both producers and users of castings. The different interested organizations will be invited to suggest representatives to act on this committee. A representative from the American Foundrymen's association, acting for the gray iron foundry industry, one from the American Malleable Castings association, representing malleable producers and a member from the Steel Founders' Society of America to act in the interest of steel founders, will be named. The nonferrous foundry industry also will be represented as will large buyers such as the National Automobile chamber of commerce, American Railway association, National Association of Purchasing Agents and others.

Fred G. Wolf, American Car & Foundry Co., stated that the extra expense incident to adding weights of castings on blue prints cannot be made to show direct returns. This was the only point in opposition registered at the Washington discussion.

On the other hand, it was pointed out that bids in various instances are solicited from certain foundries, these bids being used in price negotiations elsewhere and that a system of showing weights of castings on blueprints makes for less faulty prices and profit to all concerned in the long run.

Mr. Wetherill, in opening the conference, said adoption of the practice of having purchasing agents, through their engineers, show weights of castings on blueprints was relatively unimportant but that the possibility for less duplication of calculations should remove great loss, and that the situation has vast potentialities for waste elimination in the foundry industry. He cited the findings of the committee on the elimination of waste in industry of the Federated American Engineering societies, which estimated that 49 per cent of the gross business done in America was waste. Both Mr. Wetherill and E. E. Ely, of the division of simplified practice, emphasized that the department of commerce is co-operating in waste elimination movements, but not in an attempt to regulate business nor in a dictatorial attitude toward business.

Draftsmen Best Qualified

W. J. Corbett, the Steel Founders Society of America, Pittsburgh, read a paper in which he stated that the logical person to estimate weights of castings is the draftsman making the drawing. Many foundries, he said, have no employes available for computing the weights of castings from blueprints with any degree of accuracy, and that as a result foundries receive different weights, these variations often exceeding 100 per cent.

A J. B. Harris, the Ajax Metal Co., Philadelphia, representing the American Foundrymen's association, told of a weight guessing contest conducted by the association at the Syracuse convention last fall. This was described in THE FOUNDRY. He stated that there were 997 estimates, of which only three approximated the actual weight of 109 pounds. Mr. Harris stated that such variations lead to misleading estimates as to weights and in the remainder of the estimates covering operating costs growing finally into misleading costs. He added that the highest weights, all other conditions being the same, give a lower per pound cost but a higher casting cost, and that lowest weights give a higher per pound cost and lower casting cost.

Robert E. Belt, American Malleable Castings association, Cleveland, read a paper in which he stated that savings resulting from the proposed adoption translated into man power and thence into dollars might be estimated at $5,000,000 yearly, on the theory that 12 hours are spent daily in the foundry by engineers or superintendents in estimating weights.

Secretary Hoover of the department of commerce, in addressing the conference, emphasized the fact that co-operation of business in eliminating waste is doing away with the tendency toward legislating for business by congress, and that business has demonstrated the fact that it can cure all of its own ills.

W. N. Crafts, of the Reading Steel Casting Co., Reading, Pa., moved the adoption of the resolution for the committee to study the question involved.

Announcement of the names of the representatives on the working committee to report to a general meeting of all interested during the American Foundrymen's association convention in Detroit this fall will be made within the next few weeks.

John K. Desmond formerly with the Crucible Steel Co. of America, has been appointed Philadelphia district manager of steel sales for Henry Disston & Sons, Inc., Philadelphia.

Oven Design Shows Advance

Recent Variety of Units Permits Choice of Baking Equipment to Suit Individual Needs — Handling Item Held Important

By C. A. Barnett

TO KEEP pace with the change that is taking place in foundry practice, involving more and more complicated castings, important developments and improvements have been made in the design and construction of core and mold oven equipment. The foundryman of today recognizes the importance of well designed core and mold ovens in the successful operation of his foundry.

Increased labor costs, cost of core binders and fuel costs demand a conservation of these elements in the economical operation of the core department, in which connection a modern oven installation is an important factor.

Among the various types of ovens, the following form the general classifications; Shelf ovens, drawer-type ovens, portable rack-type ovens, car-type ovens, conveyor ovens.

Shelf ovens which form perhaps the simplest type of oven construction generally are limited to baking small cores. The core plates on which the cores are loaded are placed directly in the ovens on shelves. Shelf-type ovens are equipped with doors, which when opened, expose part or all of the shelves. In opening an oven door considerable heat escapes and the oven tender is exposed to a rush of gases from the oven chamber. For this reason drawer-type construction, in many cases is prepared.

A modern drawer-type core oven installation is illustrated by Fig. 1. With ovens of this type one or more drawers are equipped with rear closing plates which limit the escape of heat and gases when the drawers are withdrawn. The cores can be allowed to cool before unloading. Ovens of this type are particularly adaptable to small and medium cores. For efficient operation a core plate should be selected of a size to fit the ovens drawer size or the drawer should be built to conform to standard plates. In ovens of this type special attention is given to the mechanical construction to provide smoothness and freedom from vibration in operation, so that delicate cores may be handled without danger of breakage or distortion.

A limitation of the use of ovens of this type is that the cores must be transported from the core makers to the ovens. Where the core makers can be grouped relatively close to the ovens the matter of transportation labor is more than offset by the general efficiency in operation of this type of oven construction.

In larger foundries transportation of cores from the coremakers to the ovens and from the ovens to the molders or storage, is an important item. The portable rack system of operation affords reduced transportation costs. The cores are loaded directly on steel racks by the coremakers and the loaded racks are then moved by elevating platform trucks of either the hand, electric or gasoline-motor driven types to the core ovens.

Fig. 2 shows part of an installation of ovens of the portable rack-type in a large modern automotive foundry. The ovens illustrated each contain two racks 5 x 5 feet by 6 feet high. Ovens of the portable-rack type usually are designed to take either one or two racks per oven. The racks range in size from 3 x 5 feet to 5 x 7 feet long, depending upon the nature of the work, size of core plates, and other features.

Car-type ovens are employed for large core work or dry sand mold work. Fig. 3 shows a large unit of this type. Due to the size of the work handled, the greater part of the day is required to load the cars which are moved into the oven at the end of the day and the charge is baked over night. In smaller work, a transfer system often is used by which a loaded car may be shifted to any one of a number of ovens. In this manner continuous operation is obtained.

In car-type as well as portable rack-type ovens, the door construction and operation is important. Vertical lift-type, counter-balanced, insulated doors are shown in the accompanying illustration. Roller bearing sheaves in combination with gear reduction provide easy and rapid operation. Doors of this type

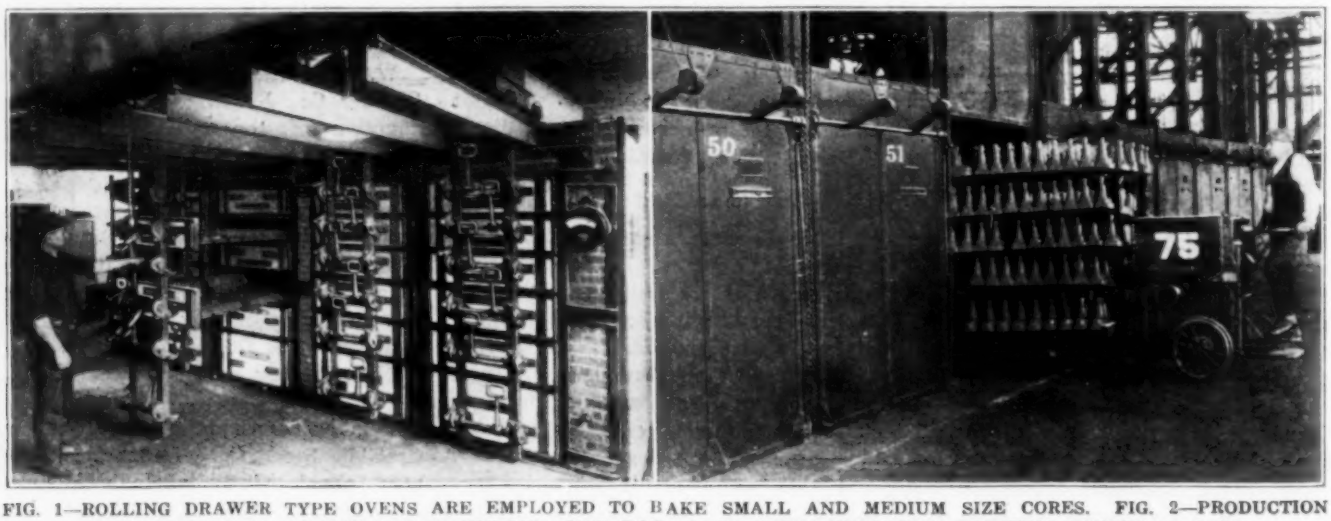


FIG. 1—ROLLING DRAWER TYPE OVENS ARE EMPLOYED TO BAKE SMALL AND MEDIUM SIZE CORES. FIG. 2—PRODUCTION SHOPS, SUCH AS AUTOMOBILE FOUNDRIES USE RACK TYPE OVENS EMPLOYING ELECTRIC TRUCKS OR CARS TO TRANSPORT THE CORES FROM BENCHES TO THE OVENS

save heat, labor and floor space.

The use of conveyor-type core ovens generally is limited to highly specialized production. It is apparent that with a conveyor moving at a definite rate of speed through an oven, only those cores which can be baked properly in approximately the same period, can be handled in the oven at the same time. Multi-conveyor ovens have been designed in which two or three conveyors moving at different rates of speed accommodate corresponding differences in baking time.

Efficient operation of a conveyor-type oven requires that the oven be synchronized with the general core handling problem and conveyor layout. In the ideal conveyor oven arrangement, the coremakers load the cores directly on carriers forming a part of the conveyor. The cores then move through the oven in a single or multiple-pass method. A definite time is allowed for cooling before the carriers reach the point where the cores are unloaded. After unloading the core driers again are placed on the carriers and ultimately reach the coremakers, completing the cycle. If the work must be brought to the conveyor oven by hand or truck and a second handling is involved, a drawer-type or rack-type oven often will do the work as efficiently at a lower initial investment.

Economy and efficiency of oven operation regardless of the type of oven involved, depends upon the kind of fuel, its cost and the efficiency of the combustion and ventilating system.

The common oven fuels in the order of their wide-spread use are as follows: Coke, fuel oil, gas and electricity.

Coke for a long time has been the widely used fuel for core and mold oven operation, but the use of fuel oil has been increasing rapidly and apparently soon will make a strong bid for first place. Coke makes a satisfactory source of heat, but its efficient and economical utilization requires a properly designed firebox and flue system to break up and diffuse the heat before it enters the oven chamber. Transportation, handling of the coke and ashes, grate bar replacement, fire-box repairs, are important cost items which must be added to the market price of the coke for the real cost of this fuel.

During the past few years many of the largest and most modern installations of core and mold ovens have been built for fuel oil operation. Each oven has its own burner or burners, except in the case of smaller ovens where a number of units may be operated from a single oil burner. The efficient use of fuel oil requires a satisfactory oil and air system. Low pressure operation with oil at 5 to 25 pounds per square inch and air from 1 to 2 pounds per square inch pressure is the general rule on this class of service. Fig 4 shows part of a battery of individually oil fired core ovens at a large automotive foundry.

Efficient and economical use of fuel oil requires a specially designed combustion and flue system with the proper diffusion of the hot gases before they enter the oven chamber. Fuel oil has the important advantage of easy and convenient control in operation.

Where natural gas still is available at moderate cost, this makes a desirable fuel. In many localities the gas companies offer special rates to industrial users of manufactured gas. Where these rates have been made attractive this fuel is finding increased favor for foundry oven operation. The cleanliness of operation and the convenient control are among the advantages of manufactured gas as a fuel for core and mold oven operation.

A number of foundries are operating ovens electrically, but in general the cost of current is too high to permit widespread use of electrically heated core and mold ovens. However, large consumers of electric power sometimes take advantage of off-peak periods, particularly in night baking, so that the power cost can be made a negligible factor.

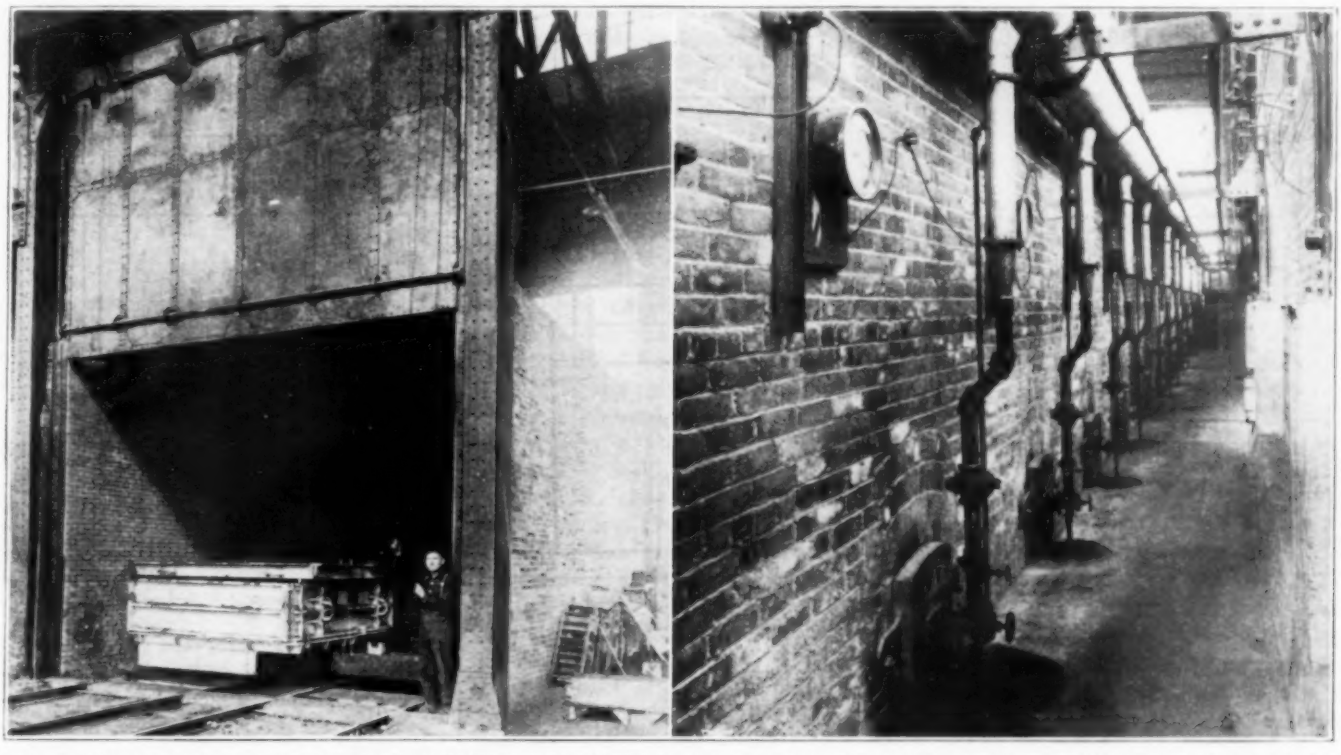


FIG. 3—LARGE CAR-TYPE OVENS ARE EMPLOYED FOR HEAVY CORES OR COMPLETE MOLDS. FIG. 4—THE FIRING PIT OF MODERN CORE OVEN INSTALLATIONS IS CLEAN AND ACCESSIBLE. OIL IS THE FUEL EMPLOYED IN THIS INSTALLATION

France exported 2990 tons of graphite and black lead during the first 10 months of 1925.

Gives Pattern Detail

And Method of Molding Axle Box

By Joseph Horner

BEARING boxes or axle boxes for British railway cars like that shown in Figs. 1, 2, 3 and 4 may be molded either by hand or by machine. The pattern is made in two sections and the mold made in a two part flask, the major portion of the box being in the drag half. The parting joint is made along *a-a* shown in Figs. 5 and 6, where which the flange of the bearing enters. In the same manner, the guide pieces for the horn blocks *C*, are made separately and attached with their core prints to the rest of the pattern. A core print *D*, wider than the axle box, is fastened at the end opposite the horn blocks. This print receives a core that carries the maker's name which is cast on the box-front.

The upper half of the pattern, above the parting joint *a-a*, Figs. 5 and 6 is made by planing down a piece of wood to the thickness of the bottom of the spring seat, and on this are fastened the guide lugs *F*, hinges *G*, and the flap door seat with its print *H*, for the grease chamber core. The timber shading shows the various pieces and their arrangement.

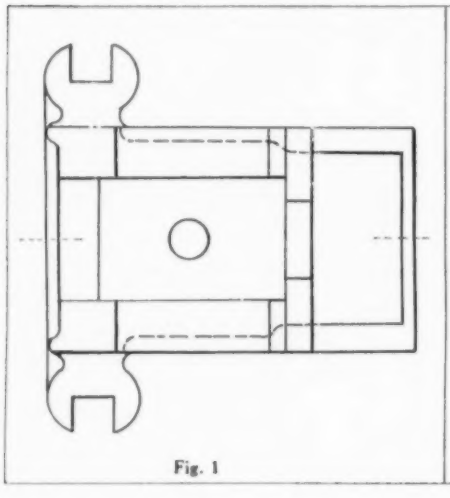


Fig. 1

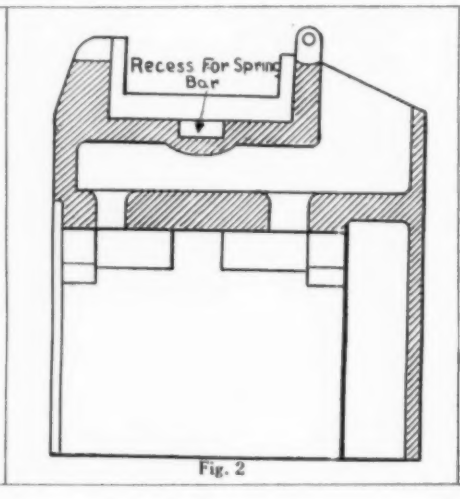


Fig. 2

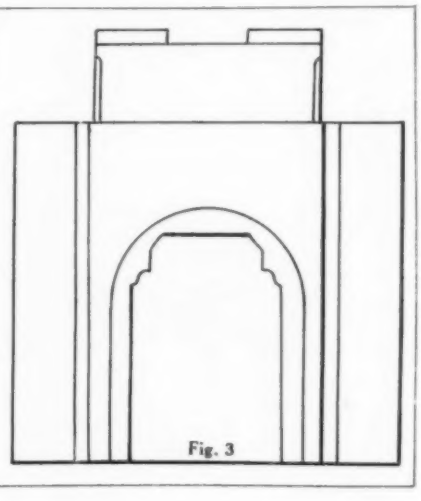


Fig. 3

the guides for the horn blocks terminate. The grooves for the horn blocks and the opening for the grease chamber are cored. In the construction of the pattern there is no hard and fast rule to be followed, and the following description will be found to serve.

The center block *A* is prepared separately from the sides *B*, and then both are glued and screwed together as in Fig. 5. The ends *I*, Fig. 7 are separate pieces shouldered in between the sides and form the recess into

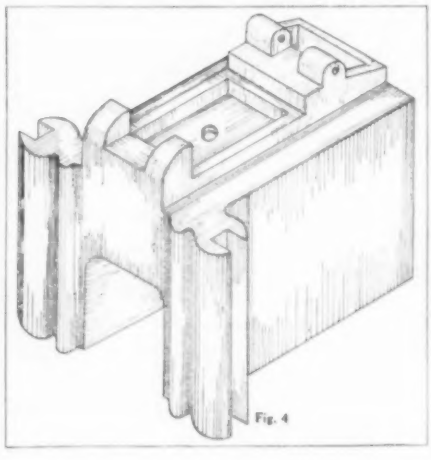


Fig. 4

The coreboxes for the grease chamber, horn blocks and name plate are made without difficulty. The corebox for the grease chamber is shown in Fig. 8. Its outline corresponds to that in Fig. 2. A bottom board for this corebox is necessary to make cores for the holes through which the grease passes to the bearing. The board is of the same thickness as that of the metal that separates the grease chamber from the bearing seat. The vertical piece *J*, shown in the upper view in Fig. 8 is used to hold the

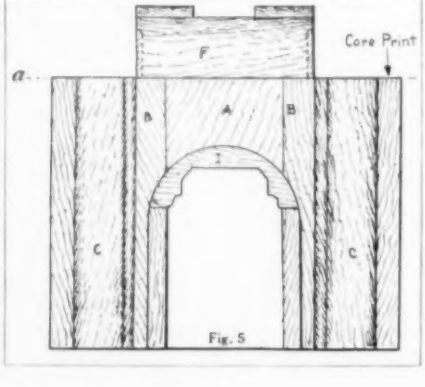


Fig. 5

Fig. 1—Top Plan of Casting. Fig. 2—Longitudinal Section. Fig. 3—Rear Elevation of Casting. Fig. 4—Isometric Sketch of Axle Box. Fig. 5—Rear Elevation of Pattern. Fig. 6—Side View of Pattern

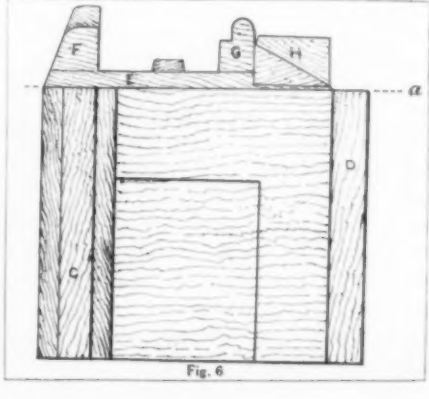


Fig. 6

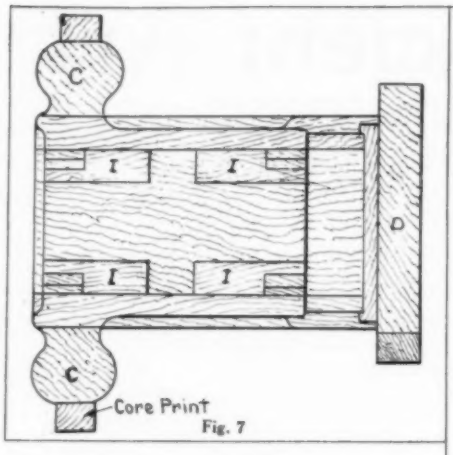


Fig. 7

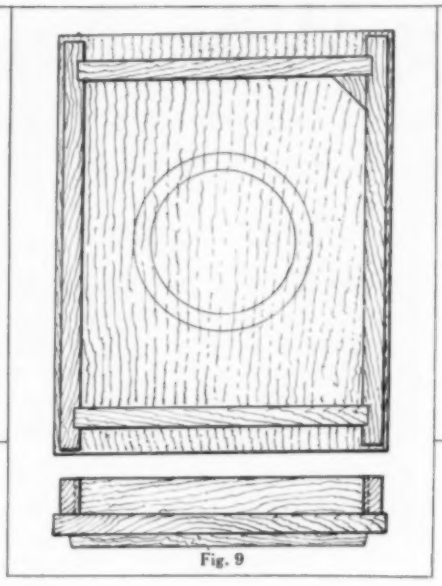


Fig. 9

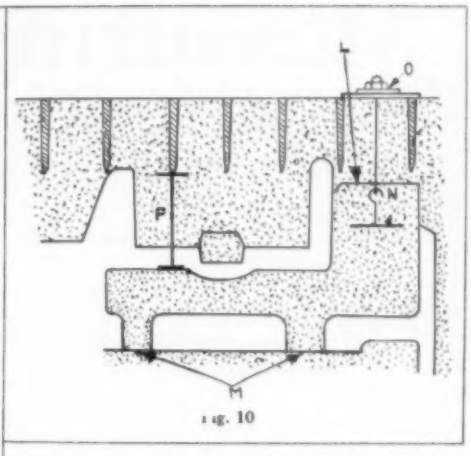


Fig. 10

Fig. 7—Underside of Pattern. Fig. 8—Corebox for Grease Chamber

Fig. 9—Corebox for Maker's Nameplate. Fig. 10—Method of Hanging Core in Cope. Fig. 11—Plan of Bottom of Mold

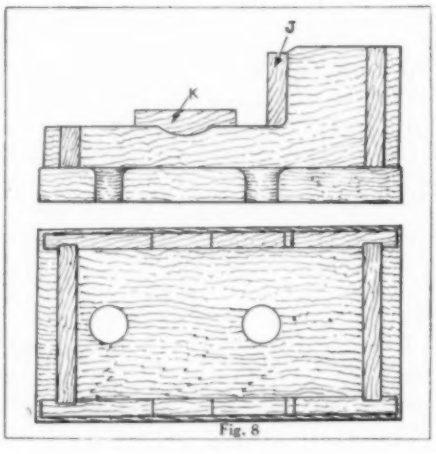


Fig. 8

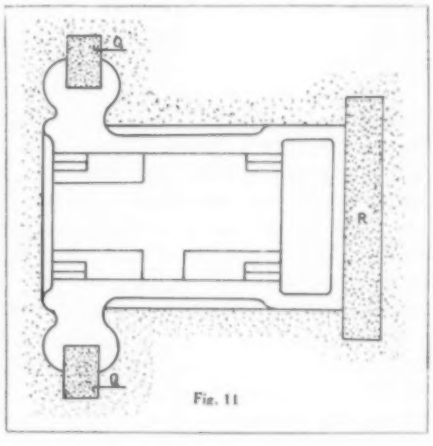


Fig. 11

sand in place and the horizontal strip *K*, carries a convex fitting to provided metal below the recess that is cast for the spring bar, see Fig. 2. The right hand portion or projecting part of the core enters the impression of the core print *H*, in Fig. 6 and the faces of the core for the grease holes rest on the lower part of the mold. The cores for the horn blocks are rectangular and the corebox needs no explanation.

The corebox for the name plate is shown in Fig. 9. It has the same outline as the print on the right side of Figs. 6 and 7. One corner of the print and core is cut off to prevent setting the core upside down. The outer frame is dowelled to the bottom board on which the name, in letters of lead or brass, is fastened.

The axle box is molded in a two part flask. The principal core is that of the grease chamber. This is secured partly in the print impression *L*, Fig. 10, and partly by resting at *M*, on the face of the drag. The core iron is provided with an eye, *N*, at the face which comes into the print impression. A hook bolt is passeu through the eye and brought through the cope and secured with a bearing on a plate that bridges two adjacent stays at *O*. Before this bolt is tightened, the thickness of the metal at the left and the steadying of the core are assured by a chaplet nail *P*, set against a stay.

The drag half of the mold is shown in the plan view in Fig. 11, with the cores for the horn blocks in place. These cores are prevented from falling out of the impressions by nails *Q*, in little grooves rubbed in the tops of the cores. The core for the nameplate *R*, is on the right.

Axle boxes also are made on plates with or without the aid of a molding machine. The joint between cope and drag remains the same as in Figs. 5 and 6, and the pattern portions on opposite sides of the plate, or on separate plates. Metal patterns generally are used on molding machines, but wood is preferable for hand molding. The patterns should be highly finished with clean faces and the minimum taper necessary for a smooth draw.

Research Assistantships Are Offered

The engineering experiment station of the University of Illinois is offering 16 research graduate assistantships for the purpose of conducting investigations in the various branches of engineering. These assistantships are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics, or applied chemistry.

Information on these positions may be obtained by addressing, the director, engineering experiment station, University of Illinois, Urbana, Ill., before April 1 when appointments will be made.

Detroit Foundrymen To Hold Meeting

The next regular meeting of the Detroit Foundrymen's association will be held on Thursday evening, March 18, at the Detroit Union League clubrooms, 35 W. Grand River avenue. E. T. Runge, Cleveland, will speak on practical cost methods. A dinner at 6:30 p. m. will precede the meeting.

Establishing an apprenticeship school jointly provided for by the government board of education and the employers with instructions given by men in the foundry industry was suggested recently by J. G. Pearce, director, British Cast Iron Research association in discussing apprentice training.

Measuring Was Ancient Art

Building Operations of Early Civilization Made Possible Only Through System of Making Measurements—English Standard Yard Used by Patternmaker

By Walter C. Ewalt

IF WE could turn back the pages of time, an interesting story could be told of the methods used by early and primitive people to make measurements of length, volume and time. Everything of any consequence which has been built by man has been measured. In the beginning of the human race, the unaided eye was used to determine length and breadth, while later sticks and poles were used. We may imagine that savages and barbarians only in a small degree had anything pertaining to a common or standard rule of measurement. Later people acquired cultivated languages, religions and arts.

Little is known of the people of Egypt in that period before they had learned to make records in stone and in writing. However, it is known that later they did wonderful things which necessitated measurements of various kinds. These wonders which have received the admiration of the whole world, emanated in measurement, which is the basis of all arts and sciences. This is proven in their architecture and in the building of the great pyramids, the greatest and most imposing monuments ever built by human hands. The surpassing grandeur of their temples, especially Karnak, is said to be the greatest of man's architectural work. Who can doubt, when reading a description of the famous pyramid of Cheops, that the Egyptians had a correct system of measuring.

These early Egyptians had a decimal system of numbers, weights and measures. They divided the year in 365 days, which gave them a measurement of time. We read of these things with wonder and astonishment and know that the civilization of these early people had progressed far.

Many measures originated in ancient times, some of which are in use today and were derived from parts of the body, such as:

The finger breadth—digitus.
The thumb breadth—pollex.
The palm or hand breadth—palmus.
The span or distance comprised between the tips of the thumb and little finger when extended. Among sailors, eight spans equal one fathom.
The length of the foot—pes.
The distance from the elbow to the tip of the middle finger—cubit.
A step—gradus.
A double step or pace equals five feet—passus.
The reach of the extended arms equals 6 feet—orgyia.

The Greek measures were decimal, that is, numbered by ten; and the Roman measures were duo-decimal or a system of numbers whose denominations rise in a scale of twelves. The Greek measure of distance was the stadium, the length of the foot race course—the Olympic stadium was 609.9 feet.

Uses Line or End Measure

Measure is a unit or standard adopted to determine the linear dimensions, volume or other quantity of other objects by the method of comparison. The measures with which the patternmaker deals are either line measures or end measures. Line measures are objects having lines marked upon them, between which it is intended that the measurement shall be made. This is also called sight measurement. End measures are objects such as bars between the ends of which it is intended that the measurement shall be made. This is called touch measurement.

Two systems of measurement are used in the pattern shop. The first is known as the long measure—that is, lineal or linear measure, which is the system or method ordinarily used by patternmakers. It has to do with fractions of inches, inches and feet. The second is called the decimal system. In this system of counting, the units are powers of 10. The decimal system is believed to have been invented in India many centuries ago. It is based probably on the use of the ten fingers to help count.

The long measure came from Great Britain from the English imperial or standard yard. This yard is marked upon a bar of Bailey's metal, composed of 16 parts copper, 2½ parts tin and 1 part zinc, and is an inch square and 38 inches long. A hole is drilled about three quarters through the depth of the bar and one inch from the end, and into the holes gold plugs are fitted whose upper end faces are level with the axis of the bar. Across each plug a fine line is marked and the distance between these lines when the temperature of the bar is 62 degrees Fahr. was made the English standard yard. The first English standard yard was legalized in England in 1824, but this standard was destroyed in 1834. The standard imperial yard bronze No. 1 was prepared and legalized in 1854. The British government made 40 copies of this and one of them, bronze No. 11, was presented to the United States in 1856. At the same time another copy known as low moor iron No. 57 was sent. These were compared with the standard imperial yard before being sent and the record of the variations sent with them.

Rules manufactured by the different companies are made to agree with the accurate standard of the government. From time to time the manufacturers' standards are compared with the government standard at the bureau of standards, Washington.

The English standard yard never has been legalized formally in the United States except in the following way: Congress passed a law in 1866 making a metric bar, which the government owned, a legal standard, defining the length of one meter 39.370 inches. This law therefore established a yard as 3600/3937 of a meter, which corresponds to the imperial yard which originated in England.

The metric system which has the meter for its fundamental unit has not been adopted so far in this country, except for scientific measurement. The meter or unit of length is intended to be one ten millionth part of the earth's meridian quadrant or 39.370 inches in length. A prototype of the original meter bar was prepared in 1899 and sent to Washington to be used as a basis of meter measurement in this country.

Metric and English or American equivalent measures:

1 meter=39.37 inches.
1 meter=3.28083 feet.
1 meter=1.0936 yards.
1 centimeter=0.3937 inch.
1 millimeter=0.03937 inch.
1 kilometer=0.62137 miles.
1 foot=0.3048 meter.

(*Concluded on Page* 249)

Engineering Training Is Applied To Foundry Problems

TALKING about coincidence which of course is the first thing that pops into one's head when presidents and New England are mentioned in the same breadth, a close analysis of the situation shows that the stern and rockbound territory bats a higher average in sending men to the presidential chair of the American Foundrymen's association than it does in seating them at the head of the table in the White House in the more or less well known city of Washington on the banks of the Potomac. The present incumbent of the White House is the first native of New England to sit on the exalted seat for 150 years; but A. B. Root who directs the destinies of the American Foundrymen's association for the current year, is the fourth prominent New England foundryman to be elected to the office of president since the association was organized in Philadelphia in 1896.

Probably there is a lesson or a moral or something to be extracted from this illuminating comparison. If so, please remember it is not copyrighted either in this language or in the Scandinavian, but is free, free as the wind that blows and each reader may apply the lesson in conformity with the dictates of his own conscience.

Al was born in Boston, a fact which in these modern days affords only the slightest clue to a man's nationality or ancestry. Fortunately, in this instance other data are available to prove that he is an American of the Americans and if his ancestors did not arrive on the Mayflower it must have been because they were too independent and decided to come in a boat of their own. Coming down to comparatively modern times we find that Al's great grandfather, his grandfather and his father all were born in the same house in the town of Dixfield, Me.

In the holiday season, during Al's undergraduate days at Tuft's college he worked for the Hunt-Spiller Mfg. Corp., South Boston and developed such a liking for the place, the people and the processes in vogue that he required no second invitation several years later to return to a responsible position in the famous old gun shop now converted not exactly to beating the weapons of war into scythes and pruning hooks, but to the production of a line of castings poured from air furnace iron.

Shortly after he graduated as a mechanical engineer he decided to see America before settling definitely in one place. He tendered his services to a powerful engineering and contracting firm which installs and operates large public utilities in widely scattered sections of the country. His offer was accepted and for the following five years including 1909 and part of 1913 he either assisted at the building or had charge of the construction and operation of various hydro-electric and steam power plants in the west and south.

Early in 1913, while engaged in the construction of a steam power plant in Savannah, Ga., the young engineer was invited by the Hunt-Spiller executive to return to Boston to assist the organization in planning a new plant and take charge of the newly created mechanical department. The prospect of returning to the old home town looked good to the wanderer and the prospect of hooking up with an establishment with which he already was familiar, looked even better. He hung up the leather jacket, the high laced boots and the sombrero, packed the good old slide rule, a tooth brush and a spare collar and came whizzing up on the Seaboard Air Line immediately, or in other words without loss of time.

In accordance with the belief that whatever is worth doing is worth doing well, the new mechanical engineer made an intensive study of foundry practice and then joined the New England Foundrymen's association. This merely was a preliminary step to afford him opportunity to examine the machinery of this technical and business organization and see what made it tick. After satisfying himself on this point he had himself elected vice president of the association in 1919 and president in 1920. From the local to the national organization was only a step. He was elected a director of the American Foundrymen's association at the Philadelphia convention in 1919, vice president in 1925 and president for 1926.

Contrary to the somewhat usual belief that foundrymen receive enough and more than enough exercise in the discharge of their daily duties, Al insists on strenuous doings outside business hours. He spends his vacations in the woods and mountains around the ancentral Maine home and thinks no more of climbing up and down mountains a mile high than he does of darting up and down the subway entrances that dot the crooked streets of Boston like so many rabbitt burrows.

Occasionally in winter just to keep his hand in he takes a little run up Mt. Washington accompanied by a few fellow members of the hardy Appalachian club. Following his return from one of these trips he modestly accepted the congratulations of friends and acquaintances who in their mind's eye had seen him valiantly breaking drifts up to his chin and gallantly leading his party to the summit. The bloom was rubbed somewhat from the lily on the following morning when a picture on the front page showed the band of hardy pioneers tramping up the trail in the wake of a four horse team dragging a snow plow.

The Shakeout

DAN M. AVEY, Editor
PAT DWYER, Engineering Editor
CHARLES VICKERS, Nonferrous Editor
FRANK G. STEINEBACH, Associate Editor

¶ What Is Reasonable Time

CASTINGS sold by jobbing foundries, practically without exception are sold upon some form of agreement to meet established standards of quality. These requirements may refer to freedom from physical defects, the attainment of certain physical properties, maximum or minimum dimensions at gage points or other limiting factors. Usually the buyer agrees to make any shortcomings in the castings supplied *within a reasonable time*. Here is where trouble begins, as the barefoot boy remarked when he stepped on the bumblebee.

THAT phrase, "within a reasonable time," is as vague and indefinite as that classic inquiry, "how long is a piece of string." Consider, for example the old-time practice of many machinery and engine builders, who stored castings in their yards to season, after taking a roughing cut. Castings in those days were stored out in the weather for months or even years before they were finally finished and assembled.

Today the hand-to-mouth policy of buying, the antipathy exhibited by many manufacturers toward any extensive inventory of semifinished materials, has shortened this period characterized as a reasonable time. In many cases castings are taken hot from the sand, rushed by truck to the customer and within a few hours are undergoing the bite of a machine tool.

WHEN the sudden slump hit the automobile business in 1920, the term, reasonable time, was stretched to its elastic limit by manufacturers who threw back tons of castings on foundries on every conceivable defect which could be found. Recently a manufacturer attempted to return a number of castings which were delivered by a jobbing foundry five or six years ago. Defects were claimed, but it is significant that the foundry was not asked to supply new castings, but rather was told that the price of the castings, in cash, was preferred by the buyer. If a specific time limit has been established after which rejections for defects could not have been asked, these difficulties would have been avoided.

¶ Credit Where Credit Is Due

THROUGH a peculiar twist in our mental makeup we are inclined to give full or nearly full credit for any piece of work performed by a group of men, to one or two members of that group. We conveniently forget or calmly ignore the fact that without the individual effort of each member of the group the piece of work never would have been brought to a successful conclusion. In the foundry field the work of the metallurgist, the designer, the molder and the salesman is recognized freely and due credit is accorded, but the important contribution of the maker of equipment and supplies is passed over in comparative silence. In many instances the men engaged in this essential phase of the industry are regarded as a more or less necessary evil, outsiders; instead of being recognized as a basic factor, perhaps one of the most essential factors in bringing the foundry industry to its present stage of development.

MAKERS of molding machines, cupolas, cranes, sand handling, cleaning and conveying equipment, core ovens, small tools and the hundred small items required in the successful production of castings on a profitable basis not only keep up with current requirements, but almost invariably anticipate the needs of the future. To a certain extent they may be regarded as the pace makers in the foundry field. In many instances they must wait for a considerable time content with the empty honor accorded pace makers, before they cash in on their ingenuity and mechanical ability. Any reference to the maintenance, growth and expansion of the foundry industry would be radically incomplete if due appreciation and credit were not accorded to the body of men who probably devote more time and study to the economical production of castings than do the men actually engaged in the foundry.

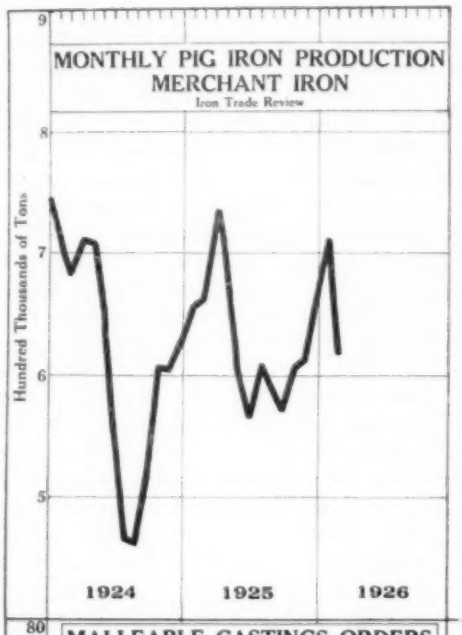
Trade Trends in Tabloid

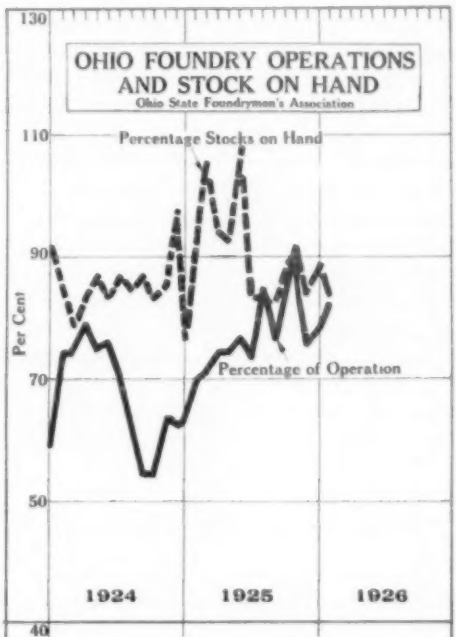
FOUNDRY business continues to be spotty, although in general it is active. In the central states operations range from 60 to 75 per cent of capacity. Improvement is noted in the Chicago district and among the implement and stove shops downstate. Demand for oil engines, logging equipment and sawmill machinery is reported brisk in the far west. Hand-to-mouth buying continues in practically all lines. Orders for castings coming to jobbing shops are accompanied by a request for immediate delivery. Demand for tire molds has slackened slightly. Automobile sales have declined, in the passenger car division, but truck orders are more active than at any period in the past few years.

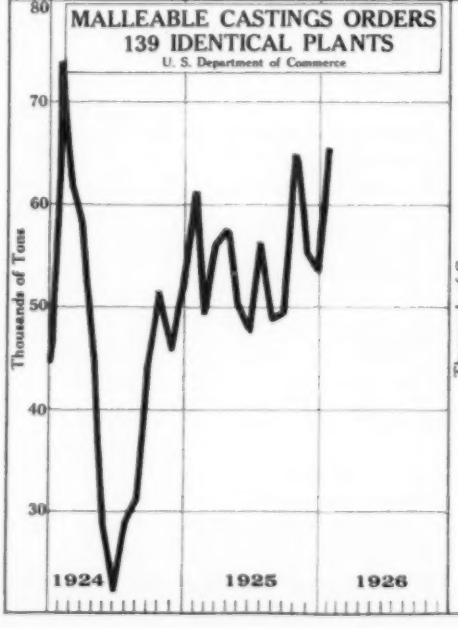
Merchant iron production decreased from 724,946 tons in January to 618,522 tons in February, according to the *Iron Trade Review*. The total output of pig iron in the past month was 2,921,449 tons, the lowest February since 1922. Average nonferrous prices for February, according to New York reports of the *Daily Metal Trade*, follow: Casting copper, 13.636c; electrolytic copper, 14.262c; Straits tin, 63.752c; lead, 9.19c; antimony, 21.743c; aluminum, 98-99 per cent, 27.00c and zinc, 7.851c, E. St. Louis, Ill. Nonferrous foundries are fairly busy, especially those which are making plumbing goods and valves and fittings. Demand for aluminum automotive castings is maintaining a steady rate.

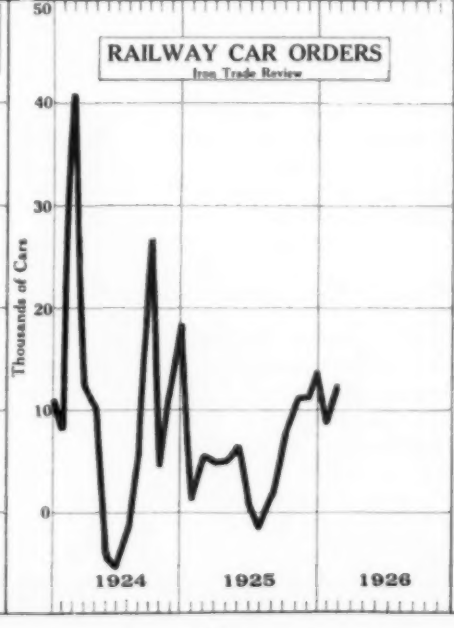
RAW MATERIAL PRICES
MARCH 6, 1926

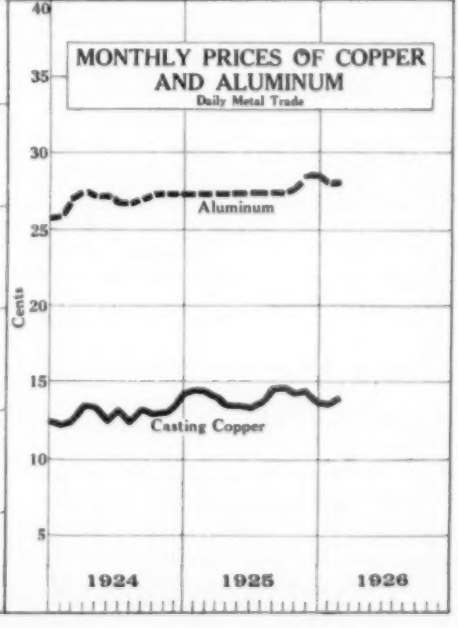
Iron	
No. 2 foundry, Valley	$20.50
No. 2 Southern Birmingham	23.00
No. 2 foundry, Chicago	23.00
No. 2 foundry, Philadelphia	22.76 to 23.39
No. 2 foundry, Buffalo	21.00
Basic, Valley	20.00
Basic, Buffalo	20.00 to 20.50
Malleable, Chicago	23.00
Malleable Buffalo	21.00
Coke	
Connellsville foundry, coke	$4.50 to 5.50
Wise County foundry, coke	5.50 to 6.00
Scrap	
Heavy melting steel, Valley	$17.00 to 17.25
Heavy melting steel, Pitts	17.00 to 18.00
Heavy melting steel, Chicago	14.00 to 14.25
Stove plate, Chicago	16.25 to 16.75
No. 1 cast, mach., New York	15.00 to 15.50
No. 1 cast, Chicago	18.75 to 19.25
No. 1 cast, Philadelphia	17.50 to 18.00
No. 1 cast, Pittsburgh	17.00 to 17.50
No. 1 cast, Birmingham	17.00 to 17.50
No. 1 cast, Buffalo	15.50 to 16.00
Car wheels, iron, Pittsburgh	18.00 to 18.50
Car wheels, iron, Chicago	16.75 to 17.25
Railroad malleable, Chicago	17.50 to 18.00
Agricultural, mal., Chicago	16.50 to 17.00
Malleable, Buffalo	18.00 to 18.50
Railroad malleable, Pitts	18.50 to 19.00
Nonferrous Metals	Cents per pound
Casting copper, refinery	13.60
Electro copper, producers	14.12½ to 14.25
Straits tin	64.00
Lead, New York	8.75
Antimony, New York	20.00 to 20.25
Nickel, electro	39.00
Aluminum, No. 1, prod'rs	26.50
Aluminum, No. 12, remelt	24.00 to 25.00
Zinc, E. St. Louis, Ill	7.45











Personal

C. A. MacDonald, formerly secretary of Nugent Steel Castings Co., Chicago, has been elected treasurer of the company.

Knowles Pittman has been appointed sales manager of the Burnside Foundry Steel Co., Chicago. Mr. Pittman formerly was sales manager of the Nugent Steel Castings Co. of that city.

H. C. Osman, sales manager of the Nugent Steel Castings Co., Chicago, has been elected secretary of the company. Mr. Osman will continue to have charge of sales.

C. R. Landolt for the past nine years foundry superintendent of the Springfield, O., and later of the Milwaukee plant of the International Harvester Co., has resigned his position at the Milwaukee plant.

Arthur S. Andersen has been elected president of the Standard Malleable Castings Co., Terre Haute, Ind. Mr. Andersen was connected with the Chicago Malleable Co. for 8 years and later was secretary of the Terre Haute Malleable & Mfg. Co.

Sherwood C. Bliss has become associated with the Richmond Radiator Co., New York, in the capacity of assistant to the president, in charge of manufacture. Mr. Bliss is well known in the heating industry. He has been connected in an engineering capacity with the production of boilers and radiators for the past 17 years.

Will Hold Exhibition

The International Foundry Trades exhibition will be held in London, England from June 10 to 19. The exhibition will be held in the Royal Agricultural hall, and is the first foundry trades exhibition held in London since 1912. This exhibition is held under the patronage of the Institute of British Foundrymen and the Foundry Trades Equipment & Supplies association. Plans and full particulars may be had from F. W. Bridges & Sons, Ltd., London.

Hold District Meeting

A group meeting of the Cleveland district foundrymen which attracted about 50 castings manufacturers was held in conjunction with a directors' meeting of the Ohio State Foundrymen's association in Cleveland, March 4. Walter L. Seelbach, Walworth Run Foundry Co. and Forest City Foundry Co., Cleveland, president of the association, presided.

Secretary A. J. Tuscany, Cleveland, presented the views of members on foundry costs and introduced the subject for roundtable discussion. C. C. Smith, Toledo Steel Casting Co., Toledo, vice president of the association, spoke on the technical group of Toledo foundrymen which recently has come into existence. Short addresses were given by Dan M. Avey, editor, and Pat Dwyer, engineering editor, THE FOUNDRY, Cleveland.

Select Detroit Committee For A. F. A. Meeting

It was decided at a meeting of the Detroit Foundrymen's association, held in the Union League club, Feb. 25, that all officers and the executive board of the association, together with the chairman of the subcommittees, should comprise the executive committee for the entertainment of the members of the American Foundrymen's association at the convention to be held in Detroit, Sept. 27 to Oct. 1. The officers of the association are as follows: President, Robert W. Crawford, Atlas Foundry Co.; vice president, J. J. Boland, Griffin Car Wheel Co.; secretary, Russell M. Scott, Packard Motor Car Co.; treasurer, Fred Cowan, W. R. Thompson Co.; executive board, K. C. Babo, Dodge Brothers; Vaughin Reid, City Pattern Work; Fred Erb, Erb-Joyce Foundry Co.; H. M. Lane, H. M. Lane Co.; J. Mahon, American Car & Foundry Co. The following have been named chairman of the various committees: Finance, E. S. Van Dalson, Dodge Brothers; Golf, Fred Erb, Erb-Joyce Foundry Co.; ladies, J. Mahon, American Car & Foundry Co.; publicity, J. J. Boland, Griffin Car Wheel Co.; hotel, G. Fuller, Federal Foundry & Supply Co.; transportation, W. R. Thompson, W. R. Thompson Co.; plant visitation, H. M. Lane, H. M. Lane Co.; entertainment, J. Cluff, F. B. Stevens Inc.; reception, C. M. Culver, Employment Managers association.

Steel Treaters Hear Bain

An address on "Metallography of the Iron-Chromium Alloys" was presented before the New York chapter of the American Society for Steel Treating at its monthly meeting, Feb. 24, by Edgar C. Bain of the Union Carbide & Carbon Research Laboratories, Inc., New York City. He presented for the first time a result of research work on stainless iron and steels.

Obituary

John Donaldson Ormrod, since boyhood associated with the Donaldson Iron Co., manufacture of cast iron pipe at Emaus, Pa. and president of that company since the death of his father several years ago, died at his home in Emaus, Feb. 23, at the age of 60. His death resulted from pneumonia. Ormrod was a director in the Lehigh Portland Cement Co., a director of the Lehigh Valley Trust Co. at Allentown, Pa.

Alfred Beauchemin, president and general manager, Beauchemin & Fils Ltd., Sorel, P. Q., Canada, whose death occurred on Feb. 14, was well known in business circles in Canada. He was 55 years of age and has been in the foundry business since 1902. Mr. Beauchemin was born on Oct. 14, 1870 in Sorel and after receiving his education in the University of Ottawa, he became a partner with his father in the foundry and agricultural industry. Much of his time in later years was spent in St. Petersburg, Fla.

Charles V. Slocum, former president of the National Car Wheel Co., Pittsburgh, died Feb. 21 in his home in that city. He had been in ill health for the last two years. Since severing his connections with the National Car Wheel Co., Mr. Slocum had been co-superintendent with his wife, Mrs. Lillian F. Slocum of the Industrial Home for Crippled Children, in Pittsburgh.

Mr. Slocum was born in Granville, N. Y., and moved with his parents when quite young to New York City, where he obtained his education. For many years he was well-known in musical circles in New York, having established himself as a concert tenor . He came to Pittsburgh about 20 years ago and associated himself with the car wheel company where by successive promotions he became its head.

Move Branch Office

Harnischfeger Sales Corp., Milwaukee, has removed its Birmingham office from 431 First National Bank building to 401 Pioneer building. J. Van Buskirk is district manager in Birmingham.

The membership in the Institute of Metals increased from 1571 to 1692 last year, this growth being registered in the face of the acute depression in the engineering and metal trades in Great Britain.

Plan Technical Program

An extensive program of technical sessions is arranged by the American Foundrymen's association for the second International Foundrymen's congress to be held at Detroit from Sept. 27 to Oct. 1. The sessions will cover all phases of foundry practice, metallurgy, shop and general management.

Some of the subjects that are scheduled are foundry costs, foundry refractory problems, sand control in the foundry, permanent and long life molds, apprentice training, materials handling, and management. These sessions will be of interest to all foundrymen. For steel foundrymen, in addition to those mentioned, a session on steel foundry shop problems and one on steel metallurgy are scheduled. John Howe Hall, R. A. Bull, Bradley Stoughton and other prominent steel foundry experts have been secured to address these gatherings.

Two special sessions pertaining to specific metallurgical and shop problems of cast iron will be held for the gray iron foundryman. The nonferrous sessions will be joint meetings of the American Foundrymen's association and the institute of metals division of the American Institute of Mining Engineers. Symposiums on temperature control and casting of nickel alloys, a luncheon round table discussion on brass foundry problems, and a session on casting aluminum and aluminum alloys will be the features for the nonferrous foundrymen.

Malleable foundrymen will have the usual session on technical problems and in addition will hold a luncheon round table discussion on practical shop problems. The tentative schedule as now arranged is given in the accompanying table.

Technical Program

Monday, Sept. 27

Afternoon—Opening of Meeting
Address of Welcome and Responses
Nonferrous Metals
Materials Handling

Tuesday, Sept. 28

Morning—Steel Founding
Nonferrous Metals
Apprentice Training
Afternoon—Luncheon Meeting and Round table Discussion on Brass Foundry Problems
Symposium on Permanent and Long Life Molds
Foundry Refractories

Wednesday, Sept. 29

Morning—Steel
Gray Iron
Malleable
Institute of Metals Division, American Institute of Mechanical Engineers
Afternoon—Costs

Thursday, Sept. 30

Morning—Foundry Sand Control
Afternoon—Malleable Round Table Discussion and Luncheon
Business Meeting
Cast Iron
Management

Friday, Oct. 1

Morning—Foundry Sand

Germans Make Cast Pipe

Gelsenkirchener Bergwerks, Germany, is understood to have arranged for the manufacture of cast pipe under patents, owned by the Centrifugal Pipe Corp. The German concern is said to have ten machines installed, ready to commence production within six weeks.

Reorganize Company

The Nugent Steel Castings Co., Chicago, which was organized in 1916 as the Electric Steel Co., now is under the direction of W. C. Frye, C. R. Messinger, both of Milwaukee and W. J. Nugent, who have purchased the interests of Charles Piez and Prentiss Coonley. The present board of directors is composed of W. J. Nugent, W. C. Frye, C. R. Messinger, C. F. Messinger, J. M. Olmstead and C. A. MacDonald Officers are: W. J. Nugent, president; Harold C. Osman, secretary, and C. A. MacDonald, treasurer.

Harold Heddon has been appointed Pittsburgh district sales manager of the New Jersey Zinc Co. He succeeds R. L. Cathcart who resigned.

Measuring Was Ancient Art

(*Concluded from Page* 244)

1 inch=2.54 centimeters.
1 inch=25.4 millimeters.

Examples

Reduce 0.10 meter to inches. 0.10x 39.37 equals 3.937 inches.

Reduce 10 meters to feet. 10x 3.28083 equals 32.8083 feet.

Reduce 10 meters to yards. 10x 1.0936 equals 10.936 yards.

Reduce 100 inches to meters. 100 divided by 39.37 equals 2.54 meters.

Reduce 10 feet to meters. 10 divided by 3.28 equals 3.04 plus meters.

Reduce 10 yards to meters. 10 divided by 1.0936 equals 9.14 meters.

The eye can and should be trained to measure objects. Much work may be saved if a space could be estimated closely by glancing. The writer once knew a man who had this quality to a surprising degree. He could cut a board closely to any length up to 16 feet. It may be presumed that he had fixed firmly in his mind the divisions of an inch, the inches in a foot and the lengths of feet. This is mentioned because he was an exceptionally fast workman and no doubt his ability to estimate distances was one of the reasons for his speed.

Foundry Association Directory

Chicago Foundrymen's Club
Chicago

CHARLES L. LARSEN, president, Armour Institute of Technology, 3200 Federal street, Chicago; E. C. BARRINGER, secretary-treasurer, THE FOUNDRY, 1147 Peoples Gas building, Chicago. Meetings second Saturday in each month at the City club, 315 Plymouth court.

The Buffalo Foundrymen
Buffalo

J. MCARTHUR, president, Washington Iron Works; W. J. WARK, secretary, E. J. Woodison Co., 146 Chandler street. Meetings the third Wednesday of the month at 146 Chandler street.

Detroit Foundrymen's Association
Detroit

ROBERT CRAWFORD, president, Atlas Foundry Co., 131 South Artillery street, Detroit; RUSSELL M. SCOTT, secretary, Packard Motor Car Co., 1580 East Grand boulevard, Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

Metropolitan Brass Foundry Association
New York

THOMAS HARPER, president, Thomas Harper, 204 Lafayette street, New York; WM. E. PAULSON, secretary, Thomas Paulson & Son, Inc., 97 Second avenue, Brooklyn, N. Y. Meetings second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

J. L. CARTER, president, Barlow Foundry, Inc., Newark; W. H. MANTZ, secretary, Atlas Foundry Co., Irvington, N. J. Meetings called by president.

Ohio State Foundrymen's Association

WALTER L. SEELBACH, president, Walworth Run Foundry Co., 2488 West Twenty-seventh street, Cleveland; ARTHUR J. TUSCANY, secretary-manager, 5713 Euclid avenue, Cleveland.

Philadelphia Foundrymen's Association
Philadelphia

CHARLES R. SPARE, president, Janney Cylinder Co., Tacony, Philadelphia; HOWARD EVANS, secretary, J. W. Paxson Co., Nicetown Lane and D street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association
Pittsburgh

WILLIAM K. FRANK, president, Damascus Bronze Co., South avenue, N. S. Pittsburgh; WM. J. BRANDT, secretary-treasurer, Wm. J. Brandt, Bessemer building, Pittsburgh. Meetings on the third Monday of the month, except in July and August, at the Fort Pitt hotel.

Quad-City Foundrymen's Association
East Moline, Ill.

P. T. BANCROFT, president, John Deere Harvester Works, East Moline, Ill.; D. H. WARD, secretary-treasurer, Union Malleable Iron Co., East Moline. Meetings the third Monday evening of each month, the meeting place being rotated between Moline, Rock Island, and Davenport.

Southern Metal Trades Association
Atlanta, Ga.

W. C. TROUT, president, Lufkin, Tex.; W. E DUNN JR., secretary-treasurer, Healey building, Atlanta, Ga. The 1926 convention to be held at Macon, Ga., the date to be announced later.

Tri-City Technical Council
Moline, Ill.

H. BORNSTEIN, chairman, Deere & Co., Moline, Ill.; MAX SKLOVSKY, treasurer, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Twin City Foundrymen's Association
Minneapolis-St. Paul

S. V. WOOD, president, Thirty-eighth avenue and Fifth street, Minneapolis; C. LANGDON, secretary. Meetings monthly at the Athletic club.

SEVERAL MEN MAY WASH AT ONE TIME WITH THE SPECIAL FIXTURE

Builds Washroom Fixture

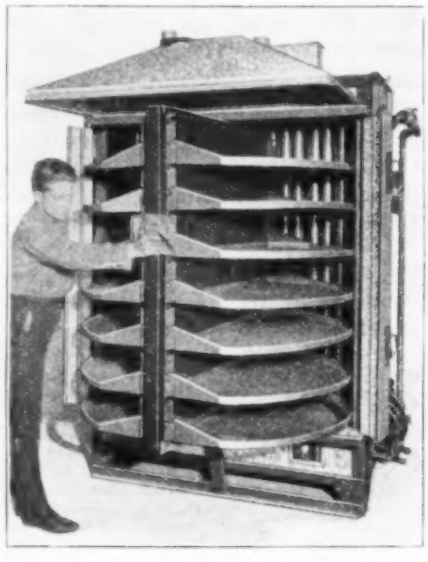
The question of designing new washrooms and improving old washrooms to secure healthy and sanitary conditions in industrial plants is receiving greater attention. It has been recognized that many of the old methods may be unsanitary and dangerous, as well as uneconomical.

A special fixture which permits a large number of persons to wash at one time, is being marketed by the Bradley Washfountain Co., Milwaukee, Wis. The fixture is circular in shape, as may be noted in the accompanying illustration and has a pipe in the center from which the water sprays. The water from the pipe really acts as a shower for the hands and face. The fountains are built in two sizes, to accommodate either six or ten people. Each person may wash in clear running water, the temperature of which is regulated. The fountain is designed so that the consumption of water is low. The flow of water may be regulated by a rosette wheel at the top of the fountain. A container for soap also is provided as shown.

Core Baking Oven Has Revolving Doors

A door oven designed for baking cores, japan baking, enamel baking, etc., recently has been introduced by the Skinner Bros. Mfg. Co., Inc., Elizabeth, N. J. This oven is built for operation with gas, electricity, oil or steam, for baking temperatures from 600 to 650 degrees Fahr.

The material to be baked is placed on grids that fit into racks. These racks are adjustable and may be spaced at 4-inch height intervals, depending on the size of the article to be baked. A half turn of the door places the charge in the oven, and at the same time removes the bake. Heat is applied by the indirect method. The oven is constructed of sheet metal panels which encase 2 inches of high heat resisting insulation. The edges are reinforced with



MATERIALS TO BE BAKED ARE SUSPENDED FROM GRIDS

steel angles, while the corners are held together with special corner plates. Asbestos heat breakers are inserted at all points where heat losses might occur.

The door is of rigid construction, heavily insulated and with pivots in ball bearings. It is sealed at the front by angular corner members and double flexible and adjustable wipers along the top and bottom. It is locked by four swinging latches attached to the corner members, which engage in wedges attached to the door. Fresh air for circulation is drawn through pipes passing through the combustion chamber, where the air is preheated before entering the baking chamber. This air may be taken from outside the plant or from the room and drawn through a filter, when desired.

Truck Crane Is Compact

Where several jobs at different places require the services of a crane, the features of speed, light weight and sturdiness are of prime importance. The new truck and trailer crane shown in the accompanying illustration, designed by the Harnischfeger Corp., Milwaukee, is said to possess these requisite features.

Compactness of the machine is obtained by arranging the three hoisting drums on one shaft. The crane is mounted on a steel frame of sturdy construction. This frame may be mounted on the chassis of a truck or on that of a trailer, and the weight of the mounting and crane, exclusive of the truck is 13,000 pounds. This light weight, according to the makers, makes it possible for a 5 or 7½ ton truck to handle the crane and lessen the danger of miring in soft ground.

The machine is driven by a 4-cylinder, 40-horsepower motor placed at the rear of the revolving frame. The motor clutch is the twin disk type, fully enclosed and ball bearing. All gears are high grade steel. The truck and trailer crane may be equipped with clam shell or drag line bucket, crane hook, magnet or other device and used for a variety of purposes.

Complete accessability, simplicity, compactness and sturdy construction are claimed by the manufacturers.

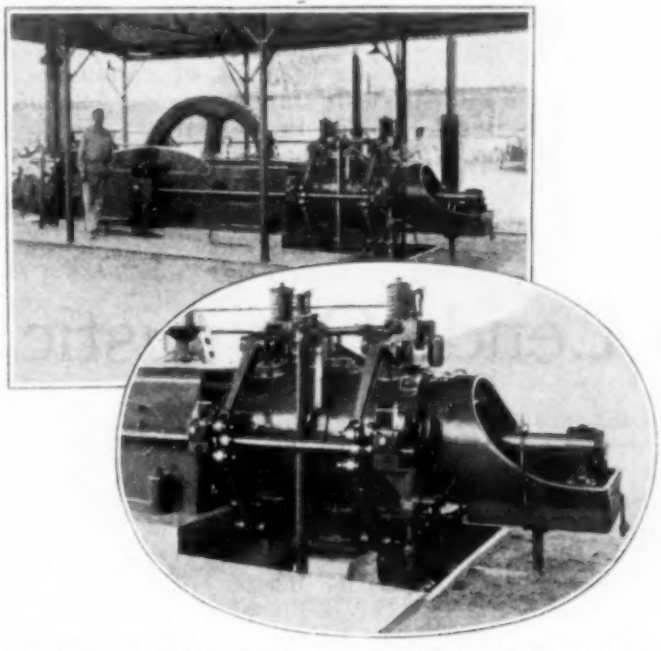
American Hoist & Derrick Co., St. Paul, recently has opened a branch office at 1943 Railway Exchange building, St. Louis. Ward B. Maurer will be in charge of this office.

THE THREE HOIST DRUMS ARE ARRANGED ON ONE SHAFT TO OBTAIN COMPACTNESS

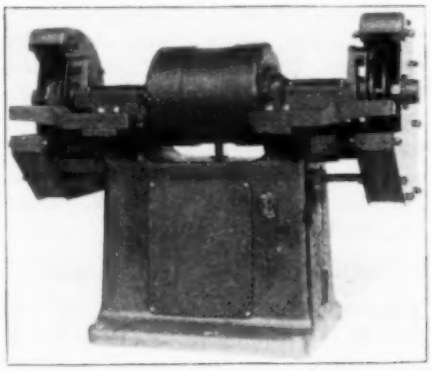
Tail Rod Construction Used on Compressor

The Worthington Pump & Machinery Corp., New York, recently has developed a tail rod construction for its four cycle double acting gas engine compressor. This construction relieves the weight of the piston on the cylinder bore and also allows greater circulation of the cooling water through the piston and rod. The box type frame of the engine is heavily ribbed and has full length bearing on the foundation. The power cylinders, which are cast of special iron, are made separately and bolted to the end of the main frame. Expansion between the inner and outer cylinder walls is taken care of by an expansion ring. Inlet and exhaust valves are located at the top and the bottom of the power cylinder. The front and rear cylinder heads are symmetrical in shape and have large water cooling spaces. The cylinder design allows easy inspection. The power piston and rod are water cooled, the circulating water entering the piston rod through the cross head, and after circulating through the piston, leaving through the tail rod. The cast iron housing with hand hole plates between the main frame and the compressor cylinder prevents gas from entering the crank case.

A belt driven governor, mounted on the side of the main frame, is connected by levers to two balanced mixing valves, one side for each power cylinder. As an extra precaution a safety flywheel stop short circuits the ignition on overspeed.



A 4-CYCLE, DOUBLE-ACTING, GAS ENGINE COMPRESSOR WITH TAIL ROD

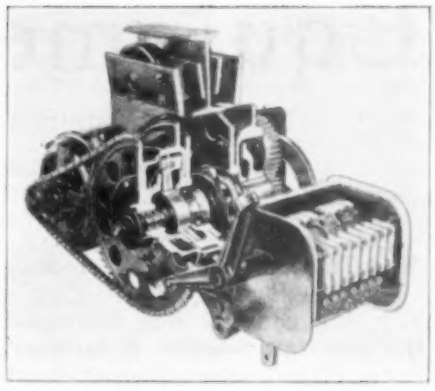


THE FLOOR TYPE GRINDING MACHINE IS ELECTRICALLY DRIVEN

Grinder Is Designed for Heavy Duty

The Ransom Mfg. Co., Oshkosh, Wis., recently has introduced a direct connected motor driven grinding machine which may find application in the foundry. The wheels are driven by a direct current variable speed motor, it being possible to increase the speed 75 per cent above normal. This enables the operator to maintain constant periphery speed as the wheel wears down toward the flanges. The machine is equipped with removable sleeve bearings of a special composition, the bearings being fitted with ring oilers. The motor is not totally enclosed, slight ventilation being provided. The guards are made of steel plate riveted. The machine is designed to carry wheels 20 inches in diameter and with a 2-inch face. An automatic accelerating starter is provided, and the operating control is through a push button switch located on the front side of the machine. The machine weighs approximately 2000 pounds.

W. V. Knowles, for the past ten years district manager at Chicago for the Titanium Alloys Mfg. Co., Niagara Falls, N. Y., has removed to Cleveland where he will be general sales representative. He also will direct the Chicago sales.



THE HOIST MAY BE ADAPTED TO ANY OVERHEAD SYSTEM

Builds Electric Hoist

An electric chain hoist which embodies such features as close headroom, long lift, high speed, automatic top and bottom stops, and great strength, recently has been developed by the Yale & Towne Mfg. Co., Stamford, Conn. The hoist may be adapted to any overhead system. The side plates of the trolley carriage can be spaced on steel bars to fit any desired beam flange.

Large steel ball bearings surrounding the substantial steel load sheaves reduce friction. The heavy steel one piece load sheave is bronze bushed for the driving pinion, and splash lubrication provides a continuous flow of oil over the gears, pinions and bearings. Steel chain containers may be supplied to hold any length of slack chain up to 60 feet for ¼, ½ and 1-ton hoists, and 30 feet for 2-ton hoists. These containers are secured to the under frame.

Elect Officers

At the annual meeting of the stockholders of the Northern Engineering Works, Detroit, the following officers and directors were elected: Henry W. Standart, president and treasurer; Harry C. Bulkley, vice president; Louis H. Olfs, secretary. These with W. Robertson, chief engineer and Joel H. Prescott constitute the board of directors.

Change Company Name

Burnside Steel Co., Chicago, has changed its name to that of the Burnside Steel Foundry Co. No change in ownership, management or personnel is involved. The company makes steel castings.

The modified Orsat apparatus for gas analysis as used at the bureau of mines gas laboratory is described in technical paper No. 320 published by the bureau of mines.

Equipment Sales Increase

Many Manufacturers Find Business Improving as Foundrymen Seek Equipment for Replacement or Extension Purposes— January Sales and Exports Decline

VOLUME of sales of foundry equipment in the various distributing centers throughout the country has increased gradually during the past few weeks. A number of manufacturers have closed on sufficient business to establish records in the amount of business realized, although others seem less fortunate. A greater number of inquiries is appearing. Foundrymen are seeking information on equipment for replacement purposes as well as for plant extensions now being planned or started. The tone of the market generally is good, and manufacturers are optimistic over the prospects for further gains.

Sales of foundry equipment in January showed a slight decline compared with December, but gained substantially over the amount for January last year, according to a report of the Foundry Equipment Manufacturers association. The value of sales in January was $406,221 as compared with $416,610 in December and $300,828 in January, 1925, the loss from December being 2 per cent and the gain over the corresponding period last year being 35 per cent. Shipments of equipment in January were valued at $437,877 as compared with $472,144 in December and $301,684 in January, 1925. Unfilled orders on Feb. 1 totaled $500,993 as compared with $550,016 on Jan. 1 and $421,918 on Feb. 1, 1925. Sales for 1925 totaled $4,665,300, as compared with $3,742,703, a gain of 25 per cent.

Exports of foundry and molding equipment in January declined, according to a recent report of the department of commerce, the value of exports in January being $42,695 as compared with $72,053 in December and $51,246 in January, 1925. The value of exports for the seven months ended January was $377,508 as compared with $348,414 during the corresponding period a year ago.

Inquiry Gain Lends Optimistic Trend

MARCH sales of foundry equipment in New England are maintaining about the same level as in February. The E. L. Le Baron Co., Brockton, Mass., has purchased a 54-inch cupola from the J. W. Paxson Co., Philadelphia, as well as several molding machines and minor equipment as part of an expansion program. The H. B. Smith Co., Westfield, Mass., has bought a dust collector system in addition to other equipment from the Paxson company. Three New England foundries tentatively are in the market for new cupolas. The Hopedale Mfg. Co., Milford, Mass., recently purchased a 48-inch cupola from the Northern Engineering Works, Detroit, while the Bridgeport Castings Co., Bridgeport, Conn., has secured several molding machines and other equipment. The Henry Perkins Co., Bridgewater, Mass., has ordered a power sprue cutter and the Sleeper Brass Foundry, Woonsocket, R. I., has purchased a brass crucible furnace. The Pangborn Corp., Hagerstown, Md., has sold sandblast equipment to the New England Iron Works., Boston, Mass. and the Howe Scale Co., Rutland, Vt. Sales of the W. W. Sly Mfg. Co., Cleveland, include a sand blast room to the General Electric Co., West Lynn, Mass., a sandblast cabinet to the Crane Co., Bridgeport, Conn., and a sandblast room with dust arrester equipment to the Draper Corp., Hopedale, Mass. Sales of sand handling and treating equipment are reported slow. The Rice, Barton & Fales Co., Worcester, Mass., has taken a molding machine from the Herman Pneumatic Machine Co., Zelienople, Pa., while the Farrel Foundry & Machine Co., Ansonia, Conn., has secured a 40-ton electric overhead crane from the Shaw Crane Co., Muskegon, Mich.

Eastern Buying Steady

FOUNDRY equipment buying in the eastern market is devoid of large orders, but nevertheless is steady. Some leading dealers assert that business thus far this year is not as large as for the corresponding period last year, or the year preceding that, although business is far from dull. Encouraging factors in the early outlook are the close proximity of the building season and the improved locomotive and car demands of the railroads. Tumbling mill equipment has been sold to Taylor & Co., Brooklyn, N. Y., and dust arrester equipment to the Aetna Foundry Co., Philadelphia, by the W. W. Sly Mfg. Co., Cleveland. The Beardsley & Piper Co., Chicago, has sold a double belt stationary type sand throwing machine to the M. W. Kellogg Co., Jersey City, N. J., and a portable type machine to the Ingersoll-Rand Co., Phillipsburg, N. J. The Elmira Foundry Co., Elmira, N. Y., has secured core oven equipment from the Whiting Corp., Harvey, Ill. The Elevator Supplies Co., Hoboken, N. J. has taken a sand mixing machine from the National Engineering Co., Chicago. Contemplated construction includes a $50,000 addition to the plant of the Hudson River Foundry Co., Poughkeepsie, N. Y., and a $75,000 foundry and machine shop for the newly organized Advance Machine & Foundry Co., Glassboro, N. J. The Somerville Iron Works, Somerville, N. J., manufacturer of cast iron soil pipe and fittings, is reported to have purchased a site in Cleveland for the erection of a branch factory, for which plans will soon be drawn. The Florence Pipe, Foundry & Machine Co., Florence, N. J., active in the eastern foundry equipment market for some time past, has recently closed on sand blast tumbling barrel equipment to the J. W. Paxson Co., Philadelphia.

Pittsburgh Sees Improvement

IMPROVEMENT is noted in the foundry equipment market in the Pittsburgh area from week to week, and the trade is extremely optimistic

concerning the outlook for the spring and summer. Sellers can only see a good buying period ahead based on the way inquiries are developing and the improvement in operation among foundries particularly the steel foundries. The Herman Pneumatic Machine Co., Zelienople, Pa., operating 100 per cent, has that same sort of a schedule mapped out for some time to come. Recent sales of that company include a large machine to the William H. Page Boiler Co., Meadville, Pa. and the Ideal Foundry & Machine Co., Beaver Falls; The Whiting Corp., Harvey, Ill. has made numerous sales of its helical worm geared ladles during the past few days, the Fort Pitt Steel Castings Co., McKees Rocks, Pa., taking a 5300-pound ladle of that type. Portable sand throwing machines have been purchased from the Beardsley & Piper Co., Chicago, by the York Mfg. Co., York, Pa., and the Ajax Iron Works, Corry, Pa., while the Textile Machine Works, Reading, Pa., has secured a tractor type machine with jib cranes from the same manufacturer. The Pangborn Corp., Hagerstown, Md., has sold sandblast equipment to the Egan-Johnson Steel & Iron Co., Crum Lynne, Pa., this being a repeat order, the Carbon Steel Casting Co., Lancaster, Pa., and McConway & Torley Co., Pittsburgh, and sandblast and dust arrester equipment to the New Holland Brass, Bronze & Aluminum Co., New Holland, Pa., and the Pittsburgh Brass Mfg. Co., Pittsburgh. Shakeout bails have been secured by the Abram Cox Stove Co., Lansdale, Pa., from the Stoney Foundry Engineering & Equipment Co., Cleveland. The National Engineering Co., Chicago, has sold a sand mixing machine to the Valley Mould & Iron Corp., Sharpesville, Pa. Crane purchases among foundry operators have increased slightly of late. The Standard Sanitary Mfg. Co., New Brighton, Pa., has ordered a 5-ton overhead crane from the Cleveland Crane & Engineering Works, Wickliffe, O. and the Allied Steel Castings Co., Chicago, bought a 5-ton 53-foot span, 3-motor crane from the Whiting Corp., Harvey, Ill. The Enterprise Bronze Co., Pittsburgh, will equip a building at 515 Reedsdale street for the production of bronze and aluminum castings.

Western Sales Good

MOST manufacturers of foundry equipment in the Chicago district find both inquiry and sales maintaining the good level of February but some apprehension is expressed lest the unsettlement in the stock and steel markets have an effect. The National Engineering Co., Chicago, has sold sand mixers to the Crucible Steel Castings Co., Milwaukee, the Crane Co., Chicago, and the Dominion Engineering Co., Montreal. Three large molding machines have been ordered by the Nugent Steel Castings Co., Chicago, and two by the National Car Coupler Co., Attica, Ind., from the Herman Pneumatic Machine Co., Zelienople, Pa. The Whiting Corp., Harvey, Ill., has sold helical worm geared ladles to the Nash Motors Co., Kenosha, Wis., and the American Manganese Steel Co., Chicago Heights, Ill., and two 7000-pound ladles of that type to the Crucible Steel Castings Co., Milwaukee, as well as a tumbling barrel to the W. A. Jones Foundry & Machine Co., Chicago. Love Bros., Aurora, Ill., have secured a tractor type sand throwing machine from the Beardsley & Piper Co., Chicago. The Standard Foundry Co., Racine, Wis., has purchased shakeout bails, and the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., the Holmes Foundry Co., Port Huron, Mich., the Standard Sanitary Mfg. Co., Louisville, Ky., and the Columbia Sanitary Mfg. Co., Louisville, have secured vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland. Sales of the W. W. Sly Mfg. Co., Cleveland include two tumbling mills to the Chicago Hardware Foundry Co., Elkhart, Ind., cinder mill equipment to the Griffin Wheel Co., Chicago, dust arrester equipment to the Wabash Foundry Co., Wabash, Ind., a large tumbling mills to the Crucible Steel Castings Co., Milwaukee, and exhaust equipment to the Service Brass & Aluminum Foundry Co., Wichita, Kan. Sandblast and dust arrester equipment has been sold to the P. B. Yates Machine Co., Beloit, Wis., and sandblast equipment to the International Harvester Co., Chicago, the Lufkin Foundry & Machine Co., Lufkin, Tex., and the A. Y. McDonald Mfg. Co., Dubuque, Ia., by the Pangborn Corp., Hagerstown, Md.

Cleveland Business Brighter

SALES of foundry equipment in the Cleveland territory have shown an upward trend with most companies during the past two weeks. Inquiries are becoming heavier, and with the extension and replacement programs getting under way, manufacturers of equipment feel that the buying movement will contiue to improve. The Standard Sand & Machine Co., Cleveland, has sold a sand mixing machine to the Superior Foundry Co., Cleveland, and the Beardsley & Pipe Co., Chicago, has placed a locomotive type sand throwing machine with the Marion Steam Shovel Co., Marion, O. The U. S. Radiator Co., Detroit, has secured vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland. Two water polishing mills have been sold to the U. S. Hame Co., Buffalo, two large tumbling mills to the Buckeye Traction Ditcher Co., Findlay, O., and three large tumbling mills to the Aluminum Co., of Canada, Arvida, Que., by the W. W. Sly Mfg. Co., Cleveland. The Herman Pneumatic Machine Co., Zelienople, Pa., has sold three large molding machines to the Massillon Steel Castings Co., Massillon, O., and two machines to the American Radiator Co., Buffalo. The National Malleable & Steel Casting Co., Cleveland, has taken sandblast equipment, from the Pangborn Corp., Hagerstown, Md. The Westinghouse Electric & Mfg. Co., Cleveland, has ordered a helical worm geared ladle and the Frontier Iron Works, Buffalo, has secured a cupola from the Whiting Corp., Harvey, Ill.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Crown Pipe & Foundry Co., Jackson, O., has been placed in the hands of S. E. Stephenson, president of the Wellston Iron & Furnace Co., Jackson, O., and I. P. Blanton, president of the Belfont Steel & Wire Co., Ironton, as co-receivers, by Judge Benner James at Jackson. Operations in production of soil pipe will be resumed at once, after the plant has been idle since early in 1925.

The Era Steel Co. has been incorporated, to take over the operation of the steel foundry and sales of manganese and alloy steel products of the Hadfield-Penfield Steel Co., Bucyrus, O., according to a statement by E. H. Haslam, president and general manager of the Hadfield-Penfield company.

Newark Pattern Works, Newark, N. J., has been incorporated with $125,000 capital to pro-

duce castings and forgings by Henry L. Rubovitz, Newark; Charles E. Rubovitz, Irvington and Gussie R. Kabot, Belleville. W Eugene Turton, Newark, is attorney.

Lewisburg Stove Co., Lewisburg, Tenn., will build addition to its foundry 72 x 120 feet.

Excel Foundries, Lebanon, N. J., has been incorporated to manufacture iron castings, grinding mills and crushers.

Kalamazoo Stove Co., Kalamazoo, Mich., will build an addition to its plant with 20,000 square feet of floor space.

United States Cast Iron Pipe & Foundry Co., Bessemer, Ala., Gordon Jones manager, is building a pattern shop and storage house.

Wayne Heater Corp., Richmond, Ind., has been sold to the Loudenslager Foundry Co., Columbus, O. Its product is a smokeless boiler.

Grand Haven Brass Foundry, 618 Lafayette avenue, Grand Haven, Mich., A. E. Jacobson manager, is planning an addition, two stories.

Alpha Brass Corp., 408 West Redwood street, Baltimore, Md., has been incorporated by William A. Covey and associates.

Model Brass Foundry, 502 South Franklin street, Chicago, will build an addition 32 x 45 feet to its foundry.

Central Foundry Co., Holt, Ala., has started construction of a pattern building. M. L. Waddell has the contract.

Detroit & Michigan Stove Co., Detroit, William T. Barbour, manager, will build a 1-story pattern shop 50 x 140 feet.

American Brass & Bronze Works, 124 Juniper street, San Francisco, is building a 1 and 2-story addition to its foundry.

American Hardware Corp., 10 Franklin square, New Britain, Conn., will build a 2-story plant 60 x 360 feet.

Bergstrom Stove Co., Neenah, Wis., will rebuild at once its burned plant and install new equipment.

Peoria Malleable Castings Co., Averyville, Ill., L. E. Robey, president, suffered damage by fire, which will be replaced immediately.

Marine City Motor Castings Co., Marine City, Mich., George E. Kramer, president, is building an addition 35 x 65 feet. (Noted Jan. 1.)

Maytag Co., Newton, Iowa, has awarded general contract to the Lanning Construction Co., Oskaloosa, Iowa, for a 2-story gray iron foundry 135 x 196 feet. (Noted Feb. 1.)

Madsen Iron Works, Los Angeles, has let contract to Union Iron Works for addition to increase capacity 40 per cent. Martin Madsen is president.

Wargo Foundry Co., Live Oak, Fla., which has has been idle for some time, will be refitted and equipped for production by H. J. Anglin and W. R. McKenna, Thomasville, Ga.

Premier Warm Air Heater Co., Dowagiac, Mich., is considering plans for a 2-story addition 100 x 100 feet for storage and distribution service.

Fulton Co., West Cumberland avenue, Knoxville, Tenn., is building two 1-story experimental laboratory buildings and a 2-story office building.

Somerville Iron Works, Somerville, N. J., manufacturer of soil pipe and fittings, is considering plans for a factory branch at Quincy avenue and Ninety-fifth street.

Cooke-Lewis Foundry Co., 422 Fields avenue, Greensboro, N. C., has bought the Westbrook Elevator Co. and plans remodeling and re-equipping.

Hutchinson Bros., 5 South Howard street, Baltimore, Md., manufacturer of furnaces and parts, will build a 1-story machine shop 32 x 100 feet.

Miller Mfg. Co., Fremont, O., recently organized, will make aluminum flasks. Charles J. Miller, Fremont Foundry Co., is president, and Joseph Karlovetz is manager.

Enterprise Bronze Co., Pittsburgh, has leased a building at 515 Reedsdale street and will equip it as a foundry for production of nonferrous castings.

Gluntz Foundry Co., 3005 East Fifty-fifth street, Cleveland, will build a 1-story addition to its foundry 60 x 126 feet and 24 x 30 feet.

Hollins Pattern Works, Detroit, has been incorporated with $15,000 capital to manufacture patterns and tools by Frederick W. Hollins, William R. Mitchell and Anthony C. Frederick, 2936 McClelland street.

Bloomfield Pattern Works, Bloomfield, N. J., has been incorporated with $20,000 capital by Peter J. McMillin, Joseph G. Kampman and Robert E. Young, East Orange. F. R. & F. H. Filch, Bloomfield, are attorneys.

Townsend & Co., Camden, N. J., has been incorporated with 1000 shares no par value to operate a foundry by S. E. Townsend, Haddonfield; Edmond H. Sharp, Camden, and Milton T. Townsend, Collinwood.

General Foundry Products Corp., Coxsackie, N. Y., has been incorporated with $100,000 capital by H. A. Kelp, E. A. Webb and H. G. Lampman. Curtis & Warren, Coxsackie, are attorneys.

Tonawanda Steel Castings Co., North Tonawanda, N. Y., has been incorporated with 250 shares common stock no par value by L. J. Fitzpatrick, C. F. Towne and F. J. Still. O'Brien & Hellings, Buffalo, are attorneys.

Peerless Malleable Castings Co., Toledo, O., has been incorporated with $250,000 preferred and 5000 shares no par value by Howard Lewis, C. T. Lewis, Robert Newbegin, Charles H. Lemmon and Milo J. Warner.

Peoria Foundry Co., 140 South Dearborn street, Chicago, has been incorporated with $70,000 capital to operate a foundry by J. J. Goshin, J. W. McAuliffe and M. M. Soentgerath. Tourje, Waugh & McClellan, 140 South Dearborn street, are correspondents.

Rex Copper Works Inc., Brooklyn, N. Y., has been incorporated with $10,000 capital to manufacture brass and copper foundry products by William Walter Jr., 17 Jefferson avenue, White Plains, N. Y.; Jacob Florea, 120 Riverside drive, New York, and Thomas F. McEvoy, 173 Barber street, Brooklyn.

New Trade Publications

BUCKETS—Buckets for all purposes are shown in a folder issued by the Hayward Co., New York.

RECORDERS—A new motor driven carbon dioxide recorder is described in a pamphlet published by the Republic Flow Meters Co., Chicago. The advantages of using, and the construction of the meter are given.

OVENS—Revolving door ovens for drying, enameling and japanning are described in a catalog issued by Skinner Bros. Mfg. Co. Inc., St. Louis. The ovens are gas fired and have removable racks. Indirect heating is used.

FURNACES—An open hearth furnace using a self-contained gas producer is described in a catalog issued by the American Bosshardt Furnace Corp., New York. These furnaces have a capacity of 3 tons and are used for steel melting.

MAGNETS—Separator magnets for removing tramp iron from raw materials are shown in a folder published by the Electric Controller & Mfg. Co., Cleveland. Magnets are of the mushroom type and the method of mounting is illustrated by actual installations.

WINDOW WASHING SYSTEMS—The Cleveland Crane & Engineering Co., Wickliffe, O., has issued a folder showing a window washing cage that is suspended from a rail around the upper part of the building. The cage may be moved along the various windows and raised and lowered to the separate stories of the building.

ELECTRIC FURNACE—Its line of electric furnaces for melting steel in the foundry is described in a bulletin by the Pittsburgh Electric Furnace Co., Pittsburgh. Large and small castings from electrically melted steel are shown and installations in various plants.

ROTARY BLOWERS—From testing toy balloons and operating calliopes to industrial furnace uses, the Connersville Blower Co., Connersville, Ind., lists applications of its rotary positive blowers in a bulletin just issued. The construction and operation of the blowers is given in detail.

VOLTAGE REGULATORS—The General Electric Co., Schenectady, N. Y., has issued a catalog describing automatic voltage regulators for alternating and direct current generators, protective relays, and speed regulators for direct motors. The construction and application of the various machines are described. Illustrations and diagrams are given also.

GRAPHITE—A folder giving the principal sources of supply and some of the uses of this product is being issued by George F. Pettinos, Philadelphia.

ELECTRIC STEAM TURBINES—General Electric Co., Schenectady, N. Y., has issued a bulletin describing the turbine-generator. Details of construction are given with some illustrations from several installations.

REFRACTORY CEMENT—Inland Fire Brick Co., Cleveland, has issued a leaflet describing its cement for use in laying furnace linings and similar uses where high heats are used. The advantages of special cement to protect fire brick are given clearly.

CAST IRON REFINING—A description of the process of refining cast iron as developed by the Mathieson Alkali Works Inc., New York, is given in a 15-page booklet. The various operations are described and the advantages of refining by this process are given.

HEATERS—Direct fired heaters manufactured by the American Blower Co., Detroit, are shown in a circular now being mailed. The principle of forced air currents to direct the heat and give greater radiation is illustrated and the various types of heaters are illustrated.

INDUSTRIAL LOCOMOTIVE—A 4-ton industrial locomotive with a gas engine power plant is described in a bulletin by the Davenport Locomotive Works, Davenport, Iowa. The advantage of this type is its standard construction and ease of replacement of parts. Its speed range is 3 to 14 miles per hour with three forward and three reverse speeds.

MACHINERY GUARDS—Various types of machinery guards are shown in a bulletin from the Cleveland Blow Pipe & Mfg. Co., Cleveland.

DUST REMOVAL—A pamphlet on dust collection systems for removing shavings and sawdust from woodworking machines, published by the Cleveland Blow Pipe & Mfg. Co., Cleveland, is illustrated with typical shop installations. Hoods and exhaust systems for other dust producers, such as buffing, polishing and grinding operations, are described in another bulletin.